ATTACHMENT 2-B
UNITED STATES EMBASSY IN BANGLADESH
BARIDHARA, DHAKA, BANGLADESH.

TENDER DOCUMENT
FOR

INSTALLATION AND COMMISSION OF WATER WELLS AT CHANCERY & ANNEX COMPOUNDS DHAKA, BANGLADESH.

ATTACHMENT 2-B
(ANNEX COMPOUND)

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STATEMENT OF WORK FOR INSTALLTION AND COMMISSION OF WATER WELLS AT CHENCHERY AND ANNEX COMPOUND DHAKA, BANGLADESH.

The United States department of state, Office of overseas Building Operations (OBO) propose to construct two new deep tube water wells at the Embassy in Dhaka, Bangladesh. This statement of work and all attachments is the basis for solicitation of proposal for the construction of the two required water wells.

1.0 GENERAL

1.1 SCOPE

A. Chancery well

One of the deep tube water wells will be drilled inside the Chancery compound. The Chancery compound is located at the Southwest corner of the intersection of Madani Avenue and Park Road in Dhaka. This water well shall be used to support the future water needs of the Chancery and surrounding building. Exact location of the proposed well site can be found in the attached plan drawings (See attachment C). The well shall be sufficient depth as may be necessary to penetrate a desirable water bearing stratum and shall produce a continuous yield of **38,000 liters of water per 16 hours period**. Based on the nearby active wells, this stratum is expected to occur at a depth of 150 meters below grade. The contractor shall then connect the new well to the existing water system at the Chancery.

B. Annex Well

The other deep tube water wells will be drilled inside the Annex compound. The Annex compound is located on the East side of Bir Uttam Rafiqul Islam Avenue, one block south of the intersection of Bir Uttam Rafiqul Islam Avenue and Madani Avenue. This water well shall be used to support the future water needs of the Annex and surrounding building. Exact location of the proposed well site can be found in the attached plan drawings (See attachment D). The well shall be sufficient depth as may be necessary to penetrate a desirable water bearing stratum and shall produce a continuous yield of **57,000 liters of water per 16 hours period**. Based on the nearby active wells, this stratum is expected to occur at a depth of 150 meters below grade. The contractor shall then connect the new well to the existing water system at the Chancery

2.0 DESIGN AND TECHNICAL REQUIREMENTS

2.1 GENERAL ARRANGEMENT OF DRAWINGS

The design basis of proposal includes the site plans of both the Chancery and Annex compounds with the exact location of the well sites indicated therein. These drawings can be found in Attachment C and Attachment D.

2.2 SPECIFICATIONS

Specifications are covered in detail in Attachment A and Attachment B. The specifications provide performance and construction requirements for the construction of both wells. The Contractor shall provide a proposal based on these specifications and other attachments to the scope of work referred to herein. Exceptions to the specifications may be considered an alternate proposal and may render the proposal subject to disqualification.

2.3 SUPERVISION OF WORK

The contractor shall provide all supervision necessary to ensure water well construction in accordance with the statement of work.

2.4 PERMITTING

The contractor must obtain all local permits required to construct the well.

2.5 PAYMENT FOR ABORTIVE OR ABANDONED WORK

Refer to the attached specification in Attachment A and Attachment B for payment provisions for aborted or abandoned work.

2.6 PROJECT NOTICE TO PROCEED

The US government shall issue a notice to proceed (NTP) will all construction. Notice to proceed shall be issued by the Contracting Officer Representative (COR) authorized by the government. Two NTP's may be issued:

1. NTP with mobilization shall be issued following award.
2. NTP with construction may be issued following completion of mobilization to the work site, upon acceptance of the Contractor's work plan and upon presentation by the contractor of satisfactory insurances to the US government.

2.7 PROJECT MONITORING

The project monitoring of performance of this water well contract provide by the government shall be through the facilities maintenance office, US Embassy, Dhaka, Bangladesh, or their representative delegated for that purpose.

2.8 CONSTRUCTION AND INSTALLATION RECORDS

The contractor shall provide all records required by the attached specifications in Attachment A and Attachment B to the COR. The contractor records shall be completed to the specification of the COR. Additionally, records shall include "as-built" drawing and specifications to the satisfaction of the Contract Officer Representative (COR) for the installed work.

3.0 ATTACHMENTS

Attachment A- Chancery well specification

Attachment B- Annex well specification

Attachment C- Chancery plan drawings

Attachment D- Annex plan drawings

PRICE

The contractor shall provide a firm fixed price proposal for construction of the two water wells at the US Embassy in Dhaka, Bangladesh in accordance with this statement of work and attachments. **Assumed depth** of the well shall be 150 meters from grade at the location provided by OBO. Increased depth providing a constructed length exceeding 150 meters shall be on the basis of unit price for additional depth by 3 meters increments. Contract Line Item (CLIN) 001 below provides for total price of two 150 meters deep tube water wells. Option contract line item 002 below provides unit price of additional depth of well in 3 meters increment. Proposal price shall include all mobilization and demobilization of materials equipments and resources necessary to construct the water well. Contractor's failure to include all related cost shall not be grounds for additional payments. The firm fixed price proposal shall remain open for acceptance by the US government for a period of 45 days following date of proposal. Any extension to acceptance period shall be at the discretion of the government and shall be subject to negotiated equitable price adjustment between the government and contractor.

CLIN 001 construct two 150 meters deep tube water wells in accordance with statement of work and attachment for firm fixed price of US dollars $.....

CLIN 002 option unit price adjustment for additional depth increment of 3 meters. Firm fixed price of US $.....per additional 3 meters depth.(or part thereof) to the final set depth of finished well more than the 150 meters basis of CLIN 001.

Basis for additional unit price payment: The basis for additional unit price payment CLIN 002 shall be borehole logs presented by the contractor identifying the set depth of final well construction. Additional payment against CLIN002 shall be calculated.

-End scope of Work-

PART 1 GENERAL

1.1 SCOPE

These specifications inform all interested parties about the equipment and materials needed to successfully complete water well. All works must be completed in accordance with the contract documents. The location shall be in accordance with the contract and approved by the Contract Officer Representative (COR) prior to commencing any work. The water well shall be to such a depth as may be necessary to penetrate a desirable water bearing stratum and produce a continuous yield of **57,000** liters of water per **16** hour period in any given day.

1.2 SITE LOCATIONS

The water bearing stratum is anticipated to be encountered at a depth of 150 meters below ground surface. No water well shall be extended to a depth greater than 200 meters below ground surface.

1.3 REFERENCES

The publication listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 53 Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
ASTM C 150 Portland cement

AMERICAN WATER WORK ASSOCIATION (AWWA)

AWWA-01	Standard method for examination of water and wastewater
AWWA A 100	(1990) Water wells
AWWA B 300	(1992) Hypochlorite's
AWWA C 200	(1991) Steel water pipes-6 inch (150 mm) and larger.
AWWA C 106	(1991) Field welded of steel water pipe.

1.4 MEASUREMENT AND PAYMENT

1.4.1 Water well

Compensation for the water well will be made at the depth stated in the contract and shall include materials, equipments and labor requires drilling, developing, performing test and completing the water well. Total depth shall be measured as the linear distance between ground surface and bottom of water well screen or bottom of inner casing, whichever is lower. The total depth of the water well shall not be greater than what is stated in the contract unless approved by the Contract Officer Representative (COR). No payment will be allowed for water wells abandoned due to faulty construction practices or for convenience of the contractor. Payment will be allowed to the contractor for water wells abandoned due to a discontinuous or very low yield. The Contract Officer Representative (COR) will make this determination and instruct the contractor to abandon the water well if required.

1.5 GENERAL REQUIREMENTS

The water well shall be located in accordance with the contract documents and shall be approved by the Contract Officer Representative (COR) in advance of any work. The water well shall bet to such a depth as may be necessary to penetrate a desirable water-bearing stratum and produce a continuous yield of 57,000 liters of water per 16 hours period in any given day. The water shall be free of harmful bacteria, chemical and physical substances as established by 40 CFR 141.

1.6 SUBMITTALS

Government approval is require for submittal with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted by contractor:

Work Plan; GA

Proposed plan for constructing water well shall be provided before beginning work. The plan shall include, but not the limited to, the proposed method of drilling and equipments to be used, details on proposed casing, grouting materials and method and equipment proposed for developing the water well and performing pump test. No work shall be performed until the drilling plan has been approved and no deviation from the approved drilling plan will be permitted without approval of the Contract Officer Representative (COR). Upon approval of the plan from Contract Officer Representative (COR) the contractor will provide the local user with this plan and coordinate all work through the user. Details of specific method to be employed to control potential contamination or pollution arising from water well installation activities shall also be included.

Tests; FIO

Reports shall be made within 24 hours following the conclusion of each test.

Permits; FIO

A copy of all permits, licenses or other requirements necessary for execution of the work shall be provided by the contractor. Before beginning work, The Contract Officer Representative (COR) shall be noticed of the type and location of water well to be constructed the method of construction and anticipated schedule for construction of the water well. A copy of all such correspondence shall be furnished by the contractor.

Boring Log; FIO

During the drilling of the water well an accurate log shall be maintained. As a minimum, the log shall include depths, elevations and descriptions of all formations encountered. The contractor shall prepare a graphic boring log that shall be used in determining the water well design, screen location and screen opening.

1.7 ENVIRONMENTAL PROTECTTION

The contractor shall take all precautions as may be required to prevent contaminated water or water having undesirable physical or chemical characteristics from entering the water supply stratum through the water well bore or by seepage from ground surface. The contractor also shall take all precautions necessary to prevent contamination of the ground surface or of surface waters resulting from the drilling of water well.

1.8 ABONDONED OF WATER WELL

In the event that the contractor fails to construct a water well of the required capacity, or should the water well be abandoned because of loss of tools or for any other cause, the contractor shall fill the abandoned hole in accordance to industry standards. The contractor shall submit an abandoned plan to the Contract Officer Representative (COR). The Contract Officer Representative (COR) shall approve the plan prior to the contractor performing any work.

1.9 TEST BORING

1.9.0 Description

The work covered under test boring shall consist of transportation, boring of test tube-well, collection of sand and water samples for testing, etc. complete in accordance with these specifications.

1.9.0 CONSTRUCTION REQUIREMENT

1.9.1 **Depth**: The scheduled depth of test tube-well may vary according to local condition and shall be determined by consultant, depending on the adequate suitable water bearing strata below the zone for housing (minimum 40 meter)

1.9.2 **Diameter**: The diameter test of tube-well shall be **38** mm for the scheduled depth of 200 meter. The diameter of the borehole shall be **50** mm for the scheduled depth.

1.9.3 **Discharge**: The test boring work shall be continued till sufficient water bearing strata of found out that is sufficient enough for the discharge of **1L/S** of the production well and it shall be finalized by the consultant.

1.10.0 GENERAL INSTRUCTION

1.10.1 Due to limitation of size there are **2 (two)** points have been kept one for test tube-well and another for d) days following eep tube-well.

1.10.2 The contractor shall submit to the consultants a Programmed which the contractor intends to follow, within **7** (seven the date of the contract.

1.11.0 BOREHOLE DRILLING

1.11.1 **Boring for test well**: Boring shall be done for **38** mm dia tube well for the scheduled **200** meter or less depth. The borehole shall be **50** mm dia for the schedule depth of **200** meter. The boring shall be done with suitable equipment manually or water jet method but without use of cow dung.

1.11.2 **Installation of Test Tube well pipe**: Supplying and installation of **38** mm dia best quality u-PVC tube well pipe, fitting and u-PVC strainer at portable water bearing strata and collection of water from test tube well for chemical test from Bangladesh University of Engineering and Technology (BUET) all complete as per direction of the Engineer.

1.11.3 **Collection of Samples**: The sample of layers of different strata of soil and sand at interval of **3.0** meter shall be collected in **0.5** Kg bags and preserved for sieve analysis of and Bangladesh University of Engineering and Technology (BUET) and representing grain size on neatly drawn log-log graph analysis. Water sample shall be collected in clean airtight bottle for chemical analysis of water of all suitable water bearing strata (of not less than the depth of 40 meter). The stander bottle required for collecting the water sample and the specified bag for soil sample should be the responsibility of the contractor. Before collection of water samples, clean strainer of 3.6 meter length shall be lowered in the strata and continuously pumped till clean water, free from all foreign particles obtained.

1.11.4 **Tests**: The contractor shall conduit **Sieve Analysis** of all sand samples including color, grade and proportion of sand-silt-clay mixture if any. Immediately after the collection of water of water samples, the contractor shall also conduit **Chemical Test** of water for its portability (drink ability) including test for arsenic, PH, Nitrate, Bi-carbonate Hardness, iron, Calcium, Manganese and traces of poisonous substance, if any. The contractors at his own shall carry out all tests from Bangladesh University of Engineering Technology (BUET))/Dept. of Public Health Engineering(DPHE) testing laboratory. The test report shall include the design of the production well with maximums discharge of **1 L/S**.

1.11.5 Material and Equipment

The contractor shall arrange all drilling pipe, strainer, pumping set and necessary machinery to conduit the test boring work including transportation and supply of all usable materials. All the materials required for construction of production well shall be brand new damage free.

PARTS-2 PRODUCTS

2.1 CASING

The casing shall be of sufficient size for the maximum yield as specified. All casing, screen and other water well materials shall be of compatible materials to prevent galvanic reaction between components of the completed water well.

2.1.1 Steel casing and coupling

Steel casing shall be the standard weight black steel pipes, conforming to ASTM A 53, or steel pipes conforming to AWWA C200, as applicable. Joint shall be either threaded or coupled, or field welded in accordance with AWWA C206. All casing shall be provided with drives shoes.

2.1.2 Inner casing

The inner casing shall have a minimum of **150** mm inside dia meter and shall be constructed of the same materials as the outer casing and the water well screen. The inner casing shall be connected directly to the top of the water well screen by an approved method.

2.2 WATERWELL SCREENS

Water well screen shall be minimum of **150** mm nominal diameter, and shall be directly connected to the bottom of the inner casing by an approved method. The screen shall be sufficient length and shall provide an intake area capable of passing not less than the minimum required yield of the water well at an entrance velocity not greater than 3.05 centimeter per second. The opening size shall be compatible with the materials surrounding the screen and shall be submitted for approval prior to installation. The water well screen shall be of sufficient size and design to hold back and support the in-situ materials surrounding the screen. The screen and all accessories required for satisfactory operation shall be essentially standard product of reliable manufacturers regularly engaged in the production of such equipment. A field constructed screen is not acceptable. “Blank” in the water well screen may be utilized in nonproductive zones and shall be considered “casing”.

2.2.1 Metal Screen

Metal screen shall be of an approved wire-wound type with wire not less than No. 7 AWG and the supporting bars not less than 6.36 mm thickness. Both wire and supporting bars shall be type 304 stainless steel, conforming to the applicable requirements of AWWA A100. If a pipe core is used, it shall be at least schedule 10 pipe and shall be of the same material as the wire. A wire-wound screen manufactured with supporting bars or core of material different from the wire will not be acceptable. Joints shall be made of threaded couplings of the same material as the screens or by brazing or welding in accordance with AWWA C206.**2.3 CEMENT GROUT**

Cement grout shall consist of Portland cement conforming to ASTM C 150, Type I or II, sand and water. Cement grout shall be proportioned not to exceed 9 liters of water per 0.3 cubic meters of cement, with a mixture of such consistency that the water well can be properly grouted. Not more than 3 percent by weight of bentonite powder may be added to reduce shrinkage.

PART-3 EXECUTIONS

3.1 WATER WELL CONSTRUCTION

3.1.1 General Requirements

The method of drilling shall be as approved by the Project Director and shall conform to all industry and local standards for well construction. The execution of the work shall be by competent workmen and performed under the direct supervision an experienced well driller. Casing pipe, well screens, and joint couplings shall be of compatible materials throughout each water well. The water well shall be drilled straight, plumb, and circular from top to bottom. The water well shall be initially drilled form the ground surface to the bottom of the outer casing. The hole below the outer casing shall fully penetrate the water bearing stratum a sufficient depth to produce the required amount of water without causing excessive velocities through the aquifer.

3.1.2 Setting Outer Casing

The outer casing shall not be less than 200 mm in diameter. The hole shall be of sufficient size to leave a concentric annular space of not less than 64 mm between the outside of the outer casing and the walls of the hole. The annular space between the outer casing and the walls of the hole shall be filled with cement grout. Acceptable methods of grouting are detailed in AWWA A100. No method will be approved that does not specify the forcing of grout from the bottom of the space to be grouted towards the surface. A suitable grout retainer, packer, or plug shall be provided at the bottom of the outer casing so that grout will not leak into the bottom of the water well. Grouting shall be done continuously in such a manner as will ensure that the entire annular space is filled in one operation. After grouting is completed, drilling operation shall not be resumed for at least 72 hours to allow proper setting of the grout. The top of the outer casing shall be a minimum 0.6 m above existing ground surface and extend to minimum depth of 7.6 m below existing grad.

3.1.3 Construction of inner Casing and Screen

After the grout has set, the hole below the outer casing shall be under reamed at the required diameter to the required depth by an approved method which will prevent caving of the hole before or during installation of the water well screen and inner casing. The water well screen and inner casing shall be lowered into the hole by a method which will allow for control of the rate of fall of the water well screen and inner casing at all times. Water well screen and inner casing shall not be dropped or allowed to fall uncontrolled into the hole. The inner casing shall extend up through the outer casing to a height of 0.6 m above existing ground surface. Approved centering devices shall be installed at a spacing of 120 degrees between the outer casing and inner casing prior to water construction at intervals not exceeding 3 m.

3.1.4 Placing packer

After the inner casing and water well screen have been installed, the annular space between the inner and outer casing shall be sealed by use of an approved packer.

3.2 INSTALLATION OF TUBEWELLS

3.2.1 **General:** The contractor shall be responsible for installation of deep tube well. The actual length of strainer and blind pipe and housing pipes to be installed shall be determined by the consultant on the basis of results obtained from test tube-well.

3.2.2 **Housing pipe:** Pump housing pipe shall be assembled by field welding preferably by using fixture to keep the joint's straight. The ends of the casing sections shall be leveled and cleaned, as per standard practice for welding and butt shapes shall be provided. All field welding shall be performed by the electric arc method after being deposited in 2 or 3 layers and each layer of welding shall be cleaned of slag and shall show uniform sections of smoothness of weld metal. The housing pipe shall be connected to the blind pipe by means of reducing socket.

3.2.3 **Strainer:** The length of strainer to be installed in water bearing stratum and the depth at which they will be installed shall be determined as per design done on the basis of the results obtained from the test tube well.

3.2.4 **Blind pipe:** The length of blind pipe to be installed shall be decided on the basis of well design. Blind pipe shall be installed using screwed joints.

3.2.5 **Bail plug:** The bottom of the tube well casing shall be provided with a bail plug having a length of **3** meter including blind pipe.

3.3 WATER WELL DEVELOPMENT

After construction, the water well shall be developed in accordance with the drilling plan. The Contractor shall develop the water well by such methods approved until the water pumped from the water well is substantially free sand. Developing equipment shall be of approved type and of sufficient capacity to remove all cutting fluids, sand, rock cutting, and any other foreign material. The water well shall be thoroughly cleaned from top to bottom before beginning the water well tests.

3.4 TESTS

During construction of the water well, whenever sufficient water is found to indicate that a water well of required capacity may be developed, or when directed, a capacity test shall be performed. If the capacity test indicates that the required capacity can be obtained, the tests for quality of water shall be made. If the capacity and quality tests indicate that the required capacity and quality can be obtained the water well shall be completed at that depth. Prior to making quality test, drilling equipment, tools and pumps contacting water well water shall be cleaned with live steam.

3.4.1 Capacity Test

The contractor shall furnish and install an approved temporary test pump, with discharge piping of sufficient size and length to conduct the water being pumped to point of discharge, and equipment necessary for measuring the rate of flow and water level in the water well. A continuous 12 hours capacity test shall be run with the pumping rate and drawdown at the water well and recorded every ½ minute during the first 5 minutes after starting the pump; then every 5 minutes for an hour; then every 20 minutes for 2 hours. From this point on, readings taken at hourly intervals are sufficient. No observation wells are available therefore all water levels must be taken in the water well being tested to determine drawdown depths. The test shall begin at the rate of the expected capacity of water well and at least that rate maintained throughout the duration of the test. If this capacity cannot be maintained for the test period, the contractor will terminate the capacity test and notify the Contract Officer Representative (COR) for direction.

3.4.2 Test for Plumpness and Alignment

No plumpness and alignment tests are necessary; however, should the faulty alignment and plumpness not as specified in paragraph 1.8 ABANDONMENT OF WATER WELL and new water well be drilled at no additional cost to the Government.

3.4.3 Test for quality of Water

When the drawdown or capacity tests have been completed, the Contractor shall secure samples of water in the suitable containers and of sufficient quantity to have bacterial, physical, and chemical analyses made by a certified testing laboratory. Tests shall address each item specified in the Water Quality Analysis Table at the end of this section. Expenses related to these analyses shall be borne by the Contractor and the results of the analyses shall be furnished to the Contract Officer Representative (COR). All sampling and analyses shall be performed using EPA approved methods, procedures, and holding times.

3.5 DISINFECTING

After completion of water well, or at the time of the yield and drawdown test, whichever is later, the water well shall be disinfected by adding chlorine, conforming to AWWA B301, or hypochlorite, conforming to AWWA B300, in sufficient quantity that a concentration of at least 50 ppm chlorine shall be attained in all parts of the water well. Chlorine solution shall be prepared and introduced into the water well in an approved manner and shall remain in the water well for a period of at least 12 hours. Disinfection of water well shall be in accordance with any method described in Section A1 thru A 10 of AWWA A100. After the contact period, the water well shall be pumped until the residual chlorine content is not greater than 1.0 ppm. The water well shall be disinfected and re- disinfected as may be required until two consecutive samples of water are found upon testing to be free from the Coli Acrogens group of organisms.

3.6 CAPPING THE WATER WELL

During construction and completion, the Contractor shall use all reasonable measures to prevent the entrance of foreign matter into the water well. The Contractor shall be held responsible for any objectionable material that may fall into the water well and any effect it may have on the water quality of the water well. Upon completion of the water well, **if the installation of pump is not done immediately**, the Contractor shall install a suitable screwed, flanged, or welded cap to prevent any pollutants from entering the water well.

3.7 CLEAN-UP

Upon completion of the water well's construction and other incidentals, all debris and surplus materials resulting from the work shall be removed from the jobsite. All drill cutting shall be spread evenly on the ground surface and all water generated while drilling or performing testing shall be properly routed under guidance from the Contract Officer Representative (COR).

WATER QUALITY ANALYSIS TABLE

Characteristics

Physical

Color
Taste
Threshold odd number
P^H
Temperature
Turbidity

Chemical (Expressed as mg/l)

Arsenic
Total hardness as CaCO3
Barium
Endrin
Cadmium
Lindane
Chromium
Methoxychlor
Copper
Toxaphene
Lead
2-4-D
Mercury
2,4,5 TP silvex
Selenium
Total Organic Halogens
Silver
Total Organic Compounds(TOC)
Fluoride
Manganese (Dissolved and total)
Iron as Fe (Dissolved and total)
Suspended solids
Total Dissolved Solids
Calcium
Magnesium
Sodium and potassium as Na Sulphates as SO_4
Chlorides
Bicarbonates as HCO_3
Carbonest as CO_3
Nitrates
Alkalinity as $CaCO_3$
Silica as SiO_2

3.8.0 INSTALLATION OF SUBMERSIBALE PUMP

3.8.1 General

The Contractor shall supply, install test and commission the submersible pump as specified in the tender schedule. The pump shall be completely factory assembled with submersible motor, built in flap type non-return valve, base plate, discharge elbow, mounting clamp etc.

The submersible pump shall be vertical spindle, fixed pitch, multistage, rod dynamic, and mixed flow type impeller which from a compact unit in conjunction which the submersible motors suitable for vertical installation.

The submersible pump set shall be capable of circulating water not less than **60litre/min discharge (flow rate) against the total head of 150 mete**r. The pump shall be suitable for installation and operation in tube well within inner casing of **150mm** diameter.

3.8.2 Pump Assembly

The pump shall have separate section for each stage bolted together with matching face accurately machined and spigot to unsure and alignment. The waterway of the pump body and intermediate bowl shall be smooth and free from surface defects.

Each pump assembly shall consist of a suction case intermediate bowls and a bearing case wherein the pump rotor shall be mounted. The suction case shall be provided with perforated strainer of stainless steel sheet. The suction case, intermediate bowls and bearing case shall be malleable steel.

Each suction case and bearing case shall be fitted with lead-tin bronze/Al-bronze bearing. A sand guard of bronze shall also be provided to protect the bearing.

3.8.3 Impeller

The impeller shall be bronze, enclosed type, statically and dynamically blanked and securely fastened to the pump shaft by key. The waterway of the impellers shall be smoothly finished.

3.8.4 Shaft Sleeve and Non-return Valve

The pump shaft shall be stainless steel, ground, polished and provided with key slots. A sleeve coupling of stainless steel connecting the motor shaft to the pump shaft shall be located within the suction casing.

The pump shall be provided with built-in non-return valve at the discharge end having flanged connection to receive the rising pipe.

3.8.5 Submersible Motor

The submersible motor shall be of wet type, water filled. Water-cooled and water lubricated, squirrel cage induction motor. The water shall lubricate the bearing and cool the waterproof insulated winding. The submersible motor shall be specially designed to operate in wide voltage fluctuation range between **380V to 440V**.

Stator of the submersible motor shall be impregnated in special waterproof varnish and the stator assembly shall be covered with special PVC insulation. The winding wire/cable shall be specially insulated by 100%waterfroof special PVC insulation.

The axial thrust generated by the pump shall be absorbed by a Mitchell tilting pad thrust bearing located at the bottom end of the motor. The motor shaft shall be scaled by radial seal rings (oil seal) to avoid any exchange between the motor fill water and the water in the well.

A pressure-compensating diaphragm shall be provided the thrust bearing to compensate the rise of pressure resulting from the expansion of the volume of water filled in the motor caused by the heat generated in the winding.

The cable shall be led out of the motor though cable seating glands and protected against mechanical damage by enable guard strips along with the length of the pump.

3.8.6 Cable

Waterproof 3 core cable of required x- sectional area shall be provided with sufficient length to connect the motor and the starter/ electric panel board in the specified pace. The cable shall be of copper wire and special PVC insulated and sheathed for 600/11000-Volt grade. The cable shall be clamped to the rising pipe by means of cable clamps placed at every 3 meter intervals at the time of installation. The cable shall be connected to the cable of the motor by means of water tight cable connectors.

3.8.7 Rising Pipe

The rising pipe shall be furnished in interchangeable sections having nominal length of 3 meter. Each rising pipe shall be of M. S. Pipe having both ends flanged especially provided with grove for cable pass, so that any mechanical damage of the cable many not occur during installation.

3.8.8 Head Plate

The steelhead plate shall be of sufficient thickness of ample strength and fitted with a 90-deg. Steel bend. The bend shall be provided with a lifting lug and boss for fitting pressure gauge. A vent hole and vent pipe shall be fitted on the head plate to brake the vacuum caused during pumping of water from the well. It is also provided with an arrangement for anchoring to foundation, so that any foreign materials not drop/enter in to the well.

3.8.9 Starting

The starting equipment shall be provided with push button type automatic star-delta starter equipped with protection against over load and locked motor condition.

3.8.10 Painting

The bowl assembly and the rising pipe shall be painted with anti-corrosive paint and thereafter with black paint

SECTION B: TECHNICAL SPECIFICATION FOR CIVIL & ELECTRICAL WORKS OF SWITCH ROOM.

EARTH WORK

1.0 SCOPE OF WORK

1.1 The work includes but not necessarily limited to, the furnishing all materials and equipment and performing all operation necessary for and properly incidental to accomplishing all excavating, removal of surplus materials away from site, compacting, backfilling and grading work, trenching and backfilling for utilities as necessary to complete the project as shown and noted on the drawings and specified therein.

1.2 Any sub-soil investigations conducted by the Contract Officer Representative (COR) will be made available for the Contractor's review. The Contract Officer Representative (COR) assumes no responsibility regarding the correctness of these data and makes them available solely for information. It is responsibility of the Contractor to verify all sub-surface conditions prior to submitting Tender.

2.0 APPLICABLE STANDARDS

2.1 Pertinent provisions of the following listed current reference standards shall apply to the work of this section, except as they may be modified herein, and are hereby made a part of this specification to the extent required.

2.2 a). American Society for Testing and Materials (ASTM)
b). American Concrete Institute (ACI).
c) Bangladesh National Building Code (BNBC-1993).

3.0 SPECIFICATIONS

3.1 **Fill**: All soil or granular materials placed to raise the natural grade of the site or to backfill excavation.

3.2 **On-site Material**: Soil or granular material which is obtained from the required excavation on the site bounded by the property limits.

3.3 **Imported Material**: soil or granular material which is hauled in from off-site areas.

3.4 **Selected Material** : On-site and /or imported material which is approved by the Contract Officer Representative (COR) for use as mechanical fill.

3.5 **Compacted Fill**: Fill upon which the Contract Officer Representative (COR) has made sufficient observations and test to determine and confirm that the fill has been placed and compacted in accordance with the specification requirements.

3.6 **Degree of Compaction** : The ratio, expressed as a percentage, of the dry density of the fill material as compacted in the field to the maximum dry density of the same material as determined by ASTM Test Designation D 1557 above.

4. INSPECTION AND TESTING

4.1.1 All site preparation, cutting and shaping, excavating, filling shall be carried out under the inspection and control of the Contract Officer Representative (COR) who will perform appropriate field and laboratory test to evaluate the suitability of fill material, the proper moisture content for compaction and degree of compaction achieved. Any fill that does not meet the specification, requirements shall be removed and/or re-compacted until the requirement are satisfied.

4.1.2 Cutting and shaping, excavating, conditioning, filling and compacting procedures require approval of the Contract Officer Representative (COR) as they are successively performed. Any work found unsatisfactory or any work disturbed by subsequent operations before approval is granted shall be corrected in an approved manner as directed by the Contract Officer Representative (COR).

4.3 Test for compaction will be made for in accordance with test procedure outlined in ASTM D1557(c), as applicable. Field testing of soils or compacted fill in place shall conform to applicable requirements of ASTM D 1556.

5. WEATHER CONDITIONS

5.1 Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by rain, fill operation shall not be resumed until field test by the Contract Officer Representative (COR) indicates that the moisture content and the density of the fill area as specified in these specifications or are condition suitable enough, in the opinion of the Contract Officer Representative (COR) for resuming the work.

5.2 The control of earth-work shall be sole responsibility of the contractor. Control method shall be subject to the approval of the Contract Officer Representative (COR) including the Contractor's equipment, plans, method and installation procedures etc.

6. SOIL MATERIALS

6.1 Selected material

6.1.1 All material to be used for mechanical fill and backfill shall be an inert, non-expansive soil (less than 50 percent passing a no. 100 standard sieve), free from vegetable matter and other deleterious substances, and of such quality that it will compact thoroughly without the presence of excessive voids when watered and rolled. Fill material shall not contain rocks or lumps over 4 inch in greatest dimension. All fill materials to be used under the building, slabs, pavements and structures and backfill shall be on-site and /or imported material, conforming to the above, with a liquid limit less than 30 and plasticity index less than 15. Excavated on-site material will be considered suitable for compacted fill if it is free from organic matter and other deleterious substances and conforms to the requirements specified above.

The Contract Officer Representative (COR) shall be notified at least one week prior to start the filling and backfilling operations so that he may select for approval samples of the material intended to be used for filling and backfilling. No material shall be placed without the approval of the Contract Officer Representative (COR).

6.2. **On-site Material**

6.2.1 Excavated earth material which is suitable for compacted fill or backfill, as determined by the Contract Officer Representative (COR), shall be conditioned for reuse and properly stock piled as directed for later filling and backfilling operations. Conditioned material shall be free of debris and rubble. All rocks and aggregates exceeding 100 mm in largest dimension and deleterious materials shall be removed and disposed off in a manner as specified herein the specifications.

6.3.1 Imported Material

6.3.1 Where conditions require the fill material to be imported shall be granular soil totally free of organic matter and shall meet or exceed the minimum requirements specified above have to be selected. In addition , imported material may consist of pit-run sand or sand-gravel mixture with a minimum size of 75 mm and not more than 5 percent passing a no. 200 US standard Sieve (wet sieve).

6.3.2 **Sand**

Sand for compacted sand fill under concrete footings, foundations, slabs, and/or brick soling or for aggregate drainage fill, shall be a clean and graded, all passing a no. 4 US Standard Sieve, conforming generally to ASTM C33 for fine aggregate, with fineness modulus not less than 1.2 or as determined by the Contract Officer Representative (COR).

7.0 STAKES AND GRADES

7.1 Contractor shall layout his work, establish all necessary marks, bench marks, grading stakes and other stakes as required, all as specified herein the specifications.

7.2 Finished elevation for work to be constructed under this contract are indicated in the drawings and unless an inconsistency therein is brought to the attention of the Contract Officer Representative (COR) in writing prior to commencement of construction, the contractor will be held responsible for the proper location and elevation of all work.

8.0 **EXCAVATION**

8.1 Excavation for foundations, pits, trenches, footings, floor slabs, concrete walks, roadway pavements, parking areas and apron and any other structures indicated as well as common excavation for grading purposes, shall be to the lines and levels required. The bottom of all trenches shall be to grade, tamped firm, clean and free from all debris or foreign matter.

8.2 Excavation shall be kept free from water at all times. Adequate equipment shall be maintained at the site in accordance with art. 5 above.

8.3 If material below and beyond the required dimensions has been removed or disturbed due to unauthorized over excavation or for any other reason, the space shall be placed, filled and compacted with selected material, as directed by the Contract Officer Representative (COR) with no additional cost to the owner.

8.4 Excavated earth material which is suitable for compacted fill or backfill, as determined by the, shall be conditioned for re-use and properly stockpiled for later use as hereinbefore specified under "Soil Material".

8.5 Abandoned sewers, piping and any other utilities encountered in the progress of excavation, shall be removed and the ends plugged with concrete or in any other manner which is acceptable to the Contract Officer Representative (COR).

8.6 Active sewers, water and gas pipes, electric power, light or telephone poles, conduits or wires and any other active utility lines encountered, shall be immediately reported to the Contract Officer Representative (COR) and authorities involved. The owner and proper authorities shall allowed free access take that measure they may deem necessary to repair, relocate or remove the obstruction as determined by the owner's representative to the satisfaction of Contract Officer Representative (COR).

8.7 All debris and excess earth shall be removed from the site and disposed off as specified in section 1C of this specification.

8.8 Open excavations, trenches and the like shall be protected with fences, barricades, cover and railing as required maintaining safe personnel and vehicular traffic passage. Freshly graded surfaces shall be protected from erosion until such time as permanent drainage and erosion control works have been installed.

9.0 COPACTED FILL

9.1 Sand: Sand for compacted fill or drainage fill shall be clean and graded sand herein before specified under "Soil Material".

9.2 Select Material: All material used for compacted fill shall be selected material as herein before specified under "Soil Materials." Clean and graded sand will also meet the requirements for select material. No material shall be placed without the approval of the Contract Officer Representative (COR).

9.3 Placing and Compacting

a) Sand and select material shall be spread uniformly in lyres not to exceed 150mm in depth before compaction. Material which does not contain sufficient moisture to compact properly shall be sprinkled with water, if it contains excess moisture it shall be aerated or permitted to dry to the proper water content. Sand and select material shall be uniformly mixed with any added water before being compacted. Each layer of spread sand and select material shall be compacted to 90 percent except as specified in (b) below.

b) The upper 300 mm sand fill under foundations and slabs shall be compacted 95 percent. The upper 300 mm of compacted fill under roadways, parking areas, apron and other brick paving where indicated shall also be compacted 95 percent.

9.4 Control of Fill: Control of fill shall consist of field inspection and testing to determine that each layer has been compacted to the required density. Any layer or portion of layer that does not attain the compaction required shall be scarified and re-compacted until the required density is obtained.

10. **METHOD OF MEASUREMENT**

10.1 Excavation and backfilling

All excavation shall be measured between the outside lines of the element in plan. No extra measurement shall be allowed for excavation in excess of that shown in drawing. Measurement for backfilling to trenches by using excavated materials shall be measured for payment. Measurement shall be made in cubic meter (cum).

10.2 Filling (Common or Compacted)

Measurement shall be made for completed work in place and shall be determined by pre-work contour levels multiplied by average sections of fills. Backfilling of foundation trenches and pits,

if not by using imported materials, shall not be measured for payment. Measurement shall be made in cubic meter (cum).

PLAIN AND REINFORCED CONCRETE

1. **SCOPE OF WORK**

The work to be performed under this section includes the manufacturing, transporting, placing, finishing and curing of all concrete as shown and noted on the drawings and as specified herein.

2. **APPLICABLE STANDARD**

2.1 **Pertinent provisions** of the following listed reference standards shall apply to the work of this section, except as they may be modified herein and are hereby made a part of this specification to the extent required.

2.2 **American Concrete Institute (ACI); Current issues**

ACI 301 Specifications for Structural Concrete for Building
ACI 211 Recommended Practices for Selecting Proportions of Normal weight Concrete
ACI 304 Recommended Practices for Measuring, Mixing, Transporting and placing of Concrete
ACI 305 Recommended Practices for Hot Weather Concreting
ACI 318 Building Code Requirements for Reinforced Concrete.

2.3. **American Society for Testing and Materials (ASTM)**

C 31 Making and Coring Concrete Compressive and Flexural Strength Test Specimens in the field.
C 33 Specification for Concrete Aggregates.
C 39 Test for Compressive Strength of Cylindrical Concrete Specimens.
C 42 Obtaining and Testing Drilled Cores and Sawed beams of Concrete.
C 87 Test for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar.
C 136 Test for Sieve or Screen Analysis of Fine and Coarse Aggregates.
C 143 Test for Slump of Portland Cement Concrete.
C 150 Specification for Portland Cement.
C 172 Sampling Fresh Concrete.
C 494 Specification for Chemical Admixtures for Concrete.
D1751 Specification for Expansion Joint Fillers for Concrete Paving and Structural construction (No Extruding and Resilient Bituminous Type)
D 1850 Specification for Concrete Joint Sealer, Cold-Application Type.

3. **MATERIALS**

3.1 **Portland Cement:** Portland cement shall conform to the specification for Portland Cement (ASTM C-150 or equal, Type-1).

3.1.1 **The cement** shall be stored in such a manner as to permit easy access for proper inspection and handling. One brand of cement shall be used throughout on the same work except by written permission from the Contract Officer Representative (COR) different type of cement shall be stored separately and shall not be mixed. The cement shall be protected from moisture and damage in transit and in storage. The floor of the store room shall be raised at least 300 mm from ground by wooden platform, dun age, or pallet and shall be maintained moisture free at all times. Deteriorated and hardened cement will not be permitted in the work and will be rejected by the Contract Officer Representative (COR). Any cement rejected shall be promptly removed from the site.

3.1.2 The cement shall meet the chemical and physical requirements of ASTM C 150 for type 1 cement. A supplier's certificate attesting to the compliance of the cement to the ASTM requirement shall be furnished with each shipment and from each source of cement procured. No cement will be approved for use in the work without such certification. The Contract Officer Representative (COR) may, at his opinion, arrange to sample and test cement delivered, in accordance with ASTM Standard, for verification of quality. Cement failing to pass such tests will be rejected for in the project.

3.2 **Concrete Aggregate :** Concrete aggregates shall conform to the "Specification for Concrete Aggregates" ASTM C-33 or to a standard acceptable to the Contract Officer Representative (COR) producing concrete strengths called for in Section 11.05 of these specifications.

3.2.1 Fine Aggregates

a) General characteristics: Fine aggregate shall consist of natural sand conforming these specifications.

b) Grading**:** Fine aggregate shall be graded within the following limits, using U. S. Standard sieve sizes:-

Sieve	Percentage Passing
20 mm	100
No. 4	95 to 100
No. 8	80 to 100
No. 16	50 to 85
No. 30	25 to 60
No. 50	10 to 30
No. 100	02 to 10

The fine aggregate shall have not more than 45 percent retained between any two consecutive sieves as shown above and its fineness modulus shall not less than 2.5.

a) **Deleterious Substances** : The amount of deleterious substances in fine aggregate shall not exceed the limits prescribed below :-

Item	Maximum, percentage by Weight of total samples
Clay lumps	3.0
Materials finer than no. 200 sieve	5.0
Coal and Lignite	1.0
Chloride content	Nil

b) **Organic Impurities**

1. Fine aggregates shall be free of injurious amounts of organic impurities. Except as herein provided, aggregate subjected to test for organic impurities and producing a colour darker than the standard shall be rejected.

2. A fine aggregate failing in the test may be used, provided that discoloration is due principal to the presence of small the quantities of coal, lignite's or similar discrete particles.

3. A fine aggregate failing in the test may be used, provided that, when tested for the effect of organic impurities on strength of mortar, the relative strength at 7 days calculated in accordance with method ASTM C-87 is not less than 95 percent.

4. Fine aggregate shall not contain any materials that are deleteriously reactive with the alkalis in the cement in an amount sufficient to cause excessive expansion of mortar or concrete.

c) Soundness : Fine aggregate subjected to five cycles of the soundness test, shall show a loss, weighted in accordance with the grading of sample complying with the limitations set forth under the head "Grading" not greater than 10 percent when sodium sulfate is used or 15 percent when magnesium sulfate is used.

3.2.2 **Coarse aggregate** :

(a) Coarse aggregate shall be as per Clause 4.3 and conforming to the requirements ASTM C-33 and shall be clean, hard, tough and grade in size, free from vegetable or other organic matter. The size coarse aggregate shall be one of the three sizes tabulated below but should be as large as possible while conforming to the condition that the largest size of aggregate shall not exceed 1/5 of the narrowest clearance between forms or ¾ of the narrowest distance between parallel reinforcement bars.

(b) Grading : grading requirement of Coarse Aggregate

Sieve No.	Nominal size (Sieve with square opening)	Amounts finer than laboratory sieve (with openings) weight percent.							
		50 mm	40 mm	25 mm	20 mm	12 mm	10 mm	No. 4	No. 8
467	40 mm to No.4	100	95 to 100	-	35 to 70	-	10 to 30	0 to 5	-
57	25 mm to No. 4	-	100	95to 100	-	25 to 60	-	0 to 10	0 to 5
67	20 mm to No.4	-	-	100	90 to 100	-	20 to 55	0 to 10	0 to 5

The fine and coarse aggregate shall be washed at least once in clean water immediately before being used in concrete production.

c) **Soundness** : Coarse aggregate, subjected to five cycles of the soundness test, shall show a loss, weighted in accordance with the grading of sample complying with designated limitations set forth under "Grading" not greater than 12 percent when sodium sulfate is used or 18 percent when magnesium sulfate is used.

d) Limits for deleterious substances in coarse aggregate:-

Item	Percentage by weight of total sample
Clay lumps	0.25
Soft particles	5.0
Materials finer than No.200 sieve	1.0
Coal and Lignite	0.5
Chloride content	Nil

e**) Abrasion**: Coarse Aggregates tested for abrasion shall have a loss of not more than 27 percent for stone chips and 33 percent for brick khoa. Loss shall be determined on the test size or sizes or more nearly corresponding to the grading is to be used, the limit on abrasion shall apply to each.

f) The boulders to be used for coarse aggregate shall have the following properties :-

Compressive strength (minimum)…..28 Mpa
Specific gravity…….2.4 to 2.6
Unit weight…….2245 to 2565 kg/ cum.
Porosity……..2.1 %
Water absorption……...1.5 to 6 % (by wt)
Minimum size…….100 mm

4 LABORATORY TEST OF MATERIALS

4.1 General: Testing of cement and aggregates will be performed in a qualified testing laboratory. The laboratory will perform all tests requested and authorized by the Contract Officer Representative (COR) & Consultant representative. Tests and manufacturer's certification of compliance with ASTM Specifications will be accepted in lieu of testing of cement, and analysis of aggregates. The Contract Officer Representative (COR) may order independent verification tests, at his discretion. Tests and services will consist of the following :

1.Testing of Portland cement in accordance with ASTM C-150.

2. Analysis of aggregates in accordance with ASTM C-33 and sieve analysis of fine and coarse aggregates in accordance with ASTM C-136.

4.2 Samples: Contractor shall furnish and deliver identified sample of all materials required for analysis and tests in the amounts required by the testing laboratory without charge. Deliver samples of cement and aggregates to the Testing Laboratory at least 30 days prior to use on the job.

4.3 Strength of concrete shall be the basis for acceptance. Concrete mix shall be designated for

Class	Minimum crushing strength on cylinder at 7 days.	Minimum crushing strength on cylinder at 28 days.	Leanest allowable mix	Location	Coarse aggregate
Conc.B	16 MPa	24 MPa	1:1.5:3	All RCC Works	Crushed Stone Chips
Conc. C	8 MPa	10 MPa	1:3:6	Foundation CC	Chips of over-burnt brick
Conc. D	14 MPa	18 MPa	1:2:4	Floor CC	Chips of over-burnt brick

5. MIX DESIGN:

5.1 Design of Concrete mixes, including recommended amount of admixture (if any) and water to be used in the mixes, shall be determined by the Contractor by test before actual work.

5.2 Upon receipt of acceptable design mixes from the Testing Laboratory, Contractor shall submit these designs to the client/consultant for review.

5.2.1 Contractor shall be responsible for incorporating into the structure concrete of the minimum strengths and slumps specified on the basis of approved mix design. No costing shall be allowed without the mix-design report.

6. MIXING

6.1 Mixing of ingredients shall be conducted in a mixture machine of approved type. Mixing shall be continued after all ingredients are in mixer for at least 1.5 minutes before any part of batch is released. Drum shall revolve at the rate of 15 to 20 revolutions per minute. D rum shall be completely emptied before any portion of succeeding batch is placed therein. Total volume of all materials used per batch shall not exceed catalogue-rated capacity of the machine. Water tank shall so arranged that the amount of water can be positively measured, while Tank is discharged, inlet shall be cut off automatically.

7. PROPORTIONING

7.1 The proportions in which the various in gradients are to be used for different parts of the work shall be as determined by trial mix.

7.2 All materials shall be measured by volume or by weight, but either method must be approved by the Contract Officer Representative (COR) . Cement content shall be the minimum amount necessary for strength, workability and plasticity. Total water for each batch shall the minimum amount to produce a plastic mixture which will work readily into the corners and angles of the forms and around reinforcement with the method of placing employed on the work, but without permitting the materials to segregate or excess free water to accumulate on the surface. The method of measuring consistency of concrete shall be controlled and checked by slump test at site.

7.3 The following slumps are suggested for the different concrete members :

		Minimum	Maximum
1.	Foundation, footing, pile cap	25 mm	40 mm
2.	Column, beam, lintel, wall	25 mm	40 mm
3.	Suspended structural slab	25 mm	40 mm
4.	Thin member	40 mm	50 mm
5.	Pile	75 mm	100 mm

The suggested slump of the concrete shall be as shown above. However, Contract Officer Representative (COR) reserve the right to order a higher or lower slump to be used whenever, in his opinion, concrete of a particular structure is required to be deposited with higher or lower slump. During the course of work, tests will be made by the contractor under the direction of the Contract Officer Representative (COR) and the contractor shall render all the necessary assistance for carrying out these tests. The amount of water to added to the concrete mix shall be determined by means of standard slump tests, (ASTM C-143) which shall be carried out daily while concrete is being placed.

8. TESTING CONCRETE

8.1 Slump : This determination shall be made at the commencement of concreting, on the occasion of each change in mix proportion, and thereafter as desired by the Contract Officer Representative (COR). The testing shall be in accordance with ASTM C-143.

8.2 Strength Tests

8.2.1 The Contract Officer Representative (COR) field personnel will prepare and cure compression test samples. One set of at least three cylinders will made in accordance with ASTM C-31 for each 100 cum of concrete fraction thereof placed each day.

8.2.2 The strength test of concrete will be performed either by Contract Officer Representative (COR) or in the testing laboratory of Bangladesh University of Engineering and Technology (BUET), BIT or any approved Laboratory desired by Contract Officer Representative (COR). Strength of test cylinders shall be at least 10 % above the required strength of concrete as shown in 4.3 above.

8.2.3 Composite samples will be taken in accordance with ASTM C 172. Each sample will be obtained from the different batch of concrete on random basis, avoiding any selection of the test batch other than by a number selected at random before commencement of concrete placement.

8.2.4 All cylinders in a set will be marked with a number on one end. The Contract Officer Representative (COR) will record this number on record of concrete placed. The cylinders will be cured at job site under field condition.

8.2.5 One cylinder from each set shall be tested at 7 day and a second at 28 days in accordance with ASTM C39 in the laboratory as directed by the Contract Officer Representative (COR). Strength at 7 days shall not be less than 75 % of the design strength.

8.2.6 The third cylinder from each set shall be kept at the job site until the 28-day test report on the second cylinder in the same set has been received by the Contract Officer Representative (COR), If this report is satisfactory, discard the third the third cylinder. In the event the second cylinder test result are below the required strength, the laboratory will then test the third cylinder at the age selected by the Contract Officer Representative (COR).

8.2.7 In the event the compressive strength of the third cylinder, when tested, is below the specified minimum, the Contract Officer Representative (COR) may require core test of hardened structure. The core sample shall be tested in accordance with ASTM C42. If such test result indicates below the required strength, the concrete in question shall be removed and replaced without cost to the owner. Any other work damaged as a result of this concrete removal shall be replaced with new materials to the satisfaction of the PD at no additional cost to the owner. The cost of coring will be deducted from the contract amount. Where core cylinder taken by the laboratory and the concrete proved to be satisfactory, the cut out section shall be restored to the original condition in a manner satisfactory to the Contract Officer Representative (COR) at no additional cost to the owner.

9.0 CONVEYING AND PLACING CONCRETE

9.1 **Notification :** the Contract Officer Representative (COR) shall be notified at least 72 hours in advance of the placing of concrete. In any case, concrete pours shall be performed in accordance with the pre-established schedule.

9.2 **Earth Bearing Surface :** Soil bottoms for footings and slabs shall be approved by the Contract Officer Representative (COR) before placing concrete.

9.3 **Forms:** Before placing concrete, forms shall be thoroughly inspected. All chips, dirt and debris shall be removed, all temporary bracing and cleats taken out, all opening for pipes, conduits and sleeves, properly boxed, all forms properly secured in their correct position and made tight, all reinforcements, anchors, steel nails, and embedded items secured in their proper places. Concrete which may be on the forms or reinforcements, and which is set or dry, shall be cleaned off and the forms and steel washed off before proceeding. Remove water and all foreign matters from forms and excavations. Unless otherwise directed, sand or sandy loam shall be moist but not saturated just prior to placing concrete.

9.4 **Anchors and Embedded Items :** Anchors, bolts, regulates, sleeves, inserts, steel nails, and any other items to be cast or embedded in the concrete shall be accurately secured in position before the concrete is placed.

9.5 Handling and depositing :

9.5.1 Concreting, once started, shall be carried on as a continuous operation until the section of approved size and shape is completed.

9.5.2 Concrete shall be handled as rapidly as practicable from the mixer to the place of final deposit by methods which prevent the separation or loss of ingredients. It shall be deposited, as nearly as practicable, in its final position to avoid re-handling or flowing.

9.5.3 Concrete shall not be dropped freely as it cause segregation. It shall not be dropped freely more than 1200 mm in height. Concrete shall be deposited to maintain a plastic surface approximately horizontal.

9.5.4 In placing in wall or thin sections of height greater than 3000 mm, opening in the forms, elephant trunk trireme pipe, or other approved device, shall be used which will permit the concrete to be placed without segregation or accumulation of hardened concrete in the forms or on exposed reinforcement. Such devices shall be installed so that the concrete will be dropped vertically.

9.5.5 Concrete which has partially hardened shall not be deposited in the work. The discharge of concrete shall be started less than 60 minutes after the introduction of mixing water. Placing of concrete shall be completed within 60 minutes of the first introduction of water into the mix.

10. PROTECTION AND CURING

10.1 Protect concrete from injurious action of the elements defacement of any nature during construction operations.

10.2 Keep concrete in a thoroughly moist condition from the time it is placed until it has cured for at least 14 days but not less than as shown in section 2-A.

10.3 All formwork, until removed, shall be kept continuously wet to prevent drying of the concrete. If any form are removed before the end of ten days after placing of concrete, the exposed concrete shall be kept continuously wet for the remaining period the concrete with burlap keep t continuously moist .Concrete shall not be allowed to dry during the curing period because of finishing operations.

10.4 Carefully protect exposed concrete corners from traffic or use which will damage them in any way.

10.5 Protect freshly placed and finished concrete slabs from damage from drying wind or rain by covering with appropriate water proof sheet materials, as and when required.

11. CONCRETE FINISHING

Surface finish of concrete shall be according to type of finish in Architectural, structural drawings or in schedule of work.

11.1 "As cast fair face" concrete surface shall receive no extra finishes and shall be level, smooth and free from surface imperfections such as honeycomb, dents, bulges, sand streak, pits, air bubbles, misalignment, offset and must be uniform in texture and colour all through, as it is cast and shall be acceptable to the Contract Officer Representative (COR). Design of form, proportioning of concrete mix and casting procedure for producing the "As cast fair face" concrete surface shall be the responsibility of the Contractor.

11.2 Making up of pits and air bubble etc. may be allowed to some extent only with permission of the Contract Officer Representative (COR) and retouching of surfaces may also be allowed in case of no uniformity of color at contractor's own cost.

11.3 Plaster finish concrete surface shall receive plaster finish later and shall be even, level and free from honeycombs, dents, bulges, sand streaks and other defects such as misalignment and offset . Patching of defective works (within limits) shall be allowed only on permission from the Contract Officer Representative (COR).

11.4 Sample panels large enough in two lifts of "As cast fair face" concrete shall be built and shall be approved by the Contract Officer Representative (COR) at least 30 days in advance before the actual work.

12. SLABS AND FLAT WORK

12.1 General: Exposed slabs and flatwork shall be placed and finished monolithically. Strike off and screed slabs to a true surface at required elevation and thoroughly compact concrete with floats and tampers to force coarse aggregate below the surface. Finish the slab on same day that concrete is placed.

12.2 Steel Trowel Finish

12.2.1 Slabs and flatworks indicated on drawings to have steel trowel finish shall receive a monolithic steel trowel finish. Surface shall be screened, wood floated and steel toweled. Trowel shall be vigorously used at an angle under pressure by the finisher until toweling gives evidence of shine or glossy as required to make a smooth, hard, dense, impervious surface and free of defects. Finishers shall work from knee boards laid flat upon the surface. Mechanical or power driven toweling machine may be used if the desired finish and level tolerances can be obtained by their use.

12.2.2 After placing concrete slabs and flatwork, do not work on the surface further until ready for floating. Begin floating when the surface water has disappeared or the concrete has stiffened to permit the operation of a power driven float or hand floating. Consolidate the surface with power driven float or by hand floating. Check and level the surface plane to a tolerance not exceeding 1:500 when tested with a 3m straightedge placed on the surface at no less than two different angles. Cut down high spots and fill low spots. Uniformly slope surface the surface to drain. Immediately after leveling, re-float the surface to a uniform, smooth texture.

12.2.3 After floating, begins the first steel trowel finishing operation, using a power driven trowel or hand trowel. Begin final toweling when the surface produces a ringing sound as the trowel is moved over the surface. Consolidate the concrete surface by the final hand-toweling operation, free from trowel marks, uniform in texture and appearance and with a surface plane tolerance not exceeding 30 mm in 3 m when checked with 3 m straightedge.

12.2.4 Basement floor slab and all exterior slabs and paving shall receive a broom finish.

12.3 Broom finish: Exposed concrete slabs and paving, where indicated in the drawings, shall receive a monolithic broom finish. Broom finish shall be done same as steel trowel finish, except that after hand toweling, concrete surface shall be finished by scoring in parallel lines with medium or coarse scoring in parallel lines with medium or coarse stable broom perpendicular to the traffic movement or in direction as indicated on the drawings. Exact texture and harshness of broom finish shall match the approved samples. Some area requires a medium broom finish as indicated in the drawings or as directed by the Contract Officer Representative (COR).

12.4 **Addition of Materials:** Addition of cement, sand, water or mortar to slab surfaces, while finishing concrete will not be permitted.

12.4.1 Slab Levels

12.4.2 All steel trowel finish and broom finish slabs, flatwork and paving shall finish to 1:500 on a straightedge in any direction.

12.4.3 Particular care shall be taken to finish toweling around the edges of the slabs so that finish surfaces at edges shall be at same elevation as the rest of the top surface of the slab. Slabs shall be laid to temporary screeds set level at the proper elevations.

12.4.4 In areas where floor drains or catch basins exist, slope or pitch finish slab surfaces to the drains or catch basins as indicated on the drawings. Where slope is not indicated, it shall be a minimum of 1:100.

13. METHOD OF MEASUREMENT

Measurement shall be made volumetrically (cum) by neat outside lines of structural elements as shown in drawing or as directed in writing by Contract Officer Representative (COR) for all classes of concrete and shall include all works of formwork. Reinforcement and other embedded items shall not be measured payment under this section.

REINFORCING STEEL

1.0 SCOPE OF WORKS

The work to be performed under the provision of this section includes furnishing, cutting, bending and placing of all steel reinforcements for all reinforced cement concrete work as shown on the drawing and as specified herein.

2.0 CODE AND STANDARDS

2.1 Pertinent provisions of the following listed codes and standards shall apply to the work of this section, as they may be modified herein and hereby made a part of its specification to the extent required.

2.2 American Concrete Institute (ACI); Current issue:

ACI 301 specifications for structural Concrete for Building, Chapter 5 – Reinforcement
ACI 315 Manual of Standard Practice for Detailing Reinforced Concrete Structures.
ACI 318 Building Code Requirements for Reinforced Concrete.

2.3 American Society for Testing and Materials (ASTM)

A 82 Specification for Cold-Drawn Steel wire for Concrete Reinforcement.
A 615 Specification deformed and plain Billet-Steel Bar for Concrete Reinforcement.

3.0 MATERIALS

3.1 Reinforcing Bars: Reinforcing bars (rebar) shall be new, deformed, billet-steel bars, conforming to ASTM A615, with a minimum specified strength of 60 ksi and ultimate tensile strength of 80 ksi which will be being bent at room temperature around a pin of the same diameter as of the steel being tested without cracking on the outside of the bent portion.

3.2 Accessories: Reinforcing accessories, consisting of spacers, chairs, ties, pre cast concrete blocks and similar item shall be provided as required for spacing, assembling and supporting the reinforcement in place.

3.3 For footings, slabs and beams use supports of concrete blocks and metal chairs. Concrete blocks shall be pre-cast with required thickness and sufficiently cured at least 14 days. Proportion shall not be less than 1:2:

3.4 For exposed-to-view concrete surface, where legs of supports are in contact with the forms, provide supports with legs which are hot-dip galvanized or plastic protected or stainless steel protected.

3.5 Tie Wire: Tie wire for reinforcement shall be No.22 gauge or heavier, black or galvanized, mild or commercial grade soft steel wire.

4.0 FABRICATION

4.1 **General:** Fabrication of steel will be in accordance with the shop drawing approved by the Contract Officer Representative (COR). Where specific details are not indicated, comply with applicable requirements of the code and standard hereinbefore specified.

4.2 **Cutting and bending**: Cutting and bending shall be performed at central location, equipped and suitable for the purpose. Bars shall be accurately cut and bent as indicated on the approved shop drawings. Bars shall be bent cold. Heating of bars for bending or straightening will not be permitted. Bars shall not be bent or straightened in any manner which will injure the material.

4.3 **Welding:** Welding of reinforcement, where indicated or approved, including preparation of bars, shall conform to the applicable requirements of AWS D12.1. Welder shall be prequalified in accordance with AWS requirements. Useful penetration butt welds by the electric arc method unless otherwise indicated or approved. Weld splices to develop 125 % of the specified yield strength of the bars, or the smaller bar in transition splices. Clean bar from oil, grease, dirt and other foreign substances and flame dry before welding. Preheat bars before welding. Stagger splices in adjacent bars.

4.4 **Fabrication tolerances**: Where fabrication tolerance is not indicated on the drawing, comply with the applicable requirements specified in ACI 301.

5.0 TESTING

5.1 Test of reinforcing steel shall be performed by BRTC, Bangladesh University of Engineering and Technology (BUET), in accordance with applicable ASTM Standards and as directed by Contract Officer Representative (COR). The Contractor will arrange for all testing and will pay for all works required of the Testing Laboratory.

5.2 When independent laboratory testing is required by Contract Officer Representative (COR), materials to analyzed or tested shall be delivered to the testing laboratory by the contractor. Specimen for testing shall be taken random from bundles as delivered from the mill.

5.3 Further testing of material already delivered to jobsite may be waived by the Contract Officer Representative (COR) provided proper certification has been furnished as hereinafter specified.

5.4 All relevant mill and laboratory test results for the materials supplied shall be submitted to the owner & Consultant.

5.5 Standard chart for steel is given below:
Measurement of M.S. works shall be given for the linear measurement of reinforcement and weight shall be calculated to the following British Standard BS 4449, BS 4461.
Specification of weight of 1000 kg = 1 Ton

Dia. of Bar mm	Weight Kg / m
6 mm	0.222
8 mm	0.395
10 mm	0.616
12 mm	0.888
14 mm	1.208
16 mm	1.579
18 mm	2.000
20 mm	2.466
22 mm	2.983
25 mm	3.854
28 mm	4.829
30 mm	5.549
32 mm	6.313

No extra claim on account of over weight of rod used than the above standard will be entertained. The contractor shall take into consideration any such differences in weight of rod in the unit price while tendering. Payment for M.S. work shall be made as per approved bar bending schedule for steel reinforcement work.

6.0 PLACING

6.1 General: Reinforcing steel shall be placed in accordance with the drawings and approved shop drawings and the applicable requirements of the code and standard herein before specified. Install reinforcement accurately and secure against movement particularly under the weight of workmen and placement of the concrete.

6.2 Reinforcement support : Bars shall be supported on metal chairs or spacers or concrete blocks, fully cured min 25mmx25mm accurately placed and securely fastened to steel reinforcement in place at a spacing not more than 1 block per 1 sqm for slab and 1 block /m for beam or as directed by the Contract Officer Representative (COR). Additional bars shall be furnished whether specifically shown on drawings or not where necessary to securely fasten reinforcement in place. Support legs of accessories in forms without embedding in the form surface. Hooks and stirrups shall be accurately spaced and wire to the reinforcing. No wood will be permitted inside the form.

6.3 Placing and Tying : reinforcement shall be set in place and rigidly & securely tied or wired with steel tie wire at all splices and all crossing points and intersections in the positions shown. Rebinding on bars on jobsite to fit existing conditions will not be permitted without written authorization of the Contract Officer Representative (COR). Point end of the wire shall be away from the form.

6.4 Spacing: Centre-to-centre distance between parallel bars shall be in accordance with the drawings or where not indicated, the clear spacing shall be nominal bar dia but in no case less than neither 25 mm nor less than 1.33 times the maximum size of aggregate or as directed and approved by the Contract Officer Representative (COR).

6.5 Splices: Laps on slices shall be adequate to transfer stress of bond. Unless indicated otherwise on the drawing, lap bars a minimum of 40 times bar dia with hook. Whenever possible, splices of adjacent bars shall be staggered a minimum lap length.

6.6 Dowels: Provide dowels where indicated or required. Dowels shall be tied securely in place before concrete is deposited. Provide additional bars for support and anchorage where required. Where sleeves are required for dowels for load transfer in slabs or for other dowels, sleeves shall be black or galvanized steel pipe, standard weight, of size required to clear dowel 3 mm all around.

6.7 Protective concrete clear covering : Except where indicated otherwise shown on drawings, the minimum concrete cover for steel reinforcement shall be as follows :-

1. Where concrete is placed against earth trench form……. 75mm
2. Slabs on grade or against earth……50 mm
3. Walls below grade, columns……38 mm
4. Walls above grade & slabs…… 25 mm
5. All other formed concrete exposed to earth……50 mm
6. Concrete in Saline zone adds 10mm extra covering over above mentioned figure.

6.8 Placement Tolerances: Where placement tolerance is not indicated on the drawing, comply with the applicable requirements specified in ACI 301. Bars may be moved as necessary to avoid interference with other bars, conduit or embedded items. If bars are moved more than one bar diameter, or enough to exceed specified tolerance, resulting arrangement of bars shall be subject to the Contract Officer Representative (COR) acceptance.

6.9 CLEANING.

Reinforcement, when in place, shall be free dirt, loose scale, paint, oil or other foreign materials.

7.0 METHOD OF MEASUREMENT

Measurement shall be made and paid for actual quantity of reinforcement placed in position and embedded in concrete as shown in drawing in as ordered by Contract Officer Representative (COR) in writing. Measurement shall not include for the splices, laps, spacers, hangers, hooks, welding, wastage of reinforcement, fasteners etc. Standard weight of reinforcement as per ASTM A615 shall be considered in the measurement. Measurement shall be made in Kg.

MASONRY WORK

1 SCOPE OF WORK

The work to be performed under the provision of this section includes furnishing of all brick Masonry work as shown and noted on the drawings and as specified herein.

2. SAMPLES

Contractor shall furnish at least 5 full size samples of brick for each frog marks proposed for use to the Contract Officer Representative (COR) for approval.

3. MATERAL

3.1 Brick shall conform with ASTM C62 grade, or equal. General requirements include the Following to be tested by BRTC , Bangladesh University of Engineering and Technology (BUET) for approvals by Contract Officer Representative (COR). Cost of tests shall be borne by the contractor.

Individual	Average of 18 nos.
Minimum compressive strength	14Mpa
Maximum water absorption by 5 hour boiling test , percent	22
Minimum saturation coefficient which is the ratio of absorption by 24 hours submersion in cold water to that by 5-hours boiling	0.88
Size of solid brick in mm is 238mmx112mmx69mm. Brick shall be pug mill molded oven baked trench kiln, the weight of one brick	4.00 kg
Efflorescence and salinity when Tested in laboratory	nil

3.2 Machine pressed bricks are proposed for use, they shall be of the size shown on the drawings and specified herein and they shall be a standard commercial product of approved manufacture, Submit sample and technical literature to the Contract Officer Representative (COR) for approval. Bricks require approval before they may be used in the work.

3.4 Cement : Portland cement conforming to ASTM Specification C150, Type -1.

3.5 Fine Aggregate : Fine aggregate shall be specified in the specification in the Concrete works. The F.M of sand shall not be less than 1.5

3.6 Water : Water shall be specified in the specification in the Concrete works

4.0 MORTAR

4.1 Cement mortar shall consist of a mixture by weight or volume of fine aggregate. Mixed in Proportion as specified in schedule of work or as shown in drawing. The method of mixed mortar, either by weight or volume, requires approval of the Contract Officer Representative (COR).

4.2 The cement and sand (F.M. 1.50) shall be mixed dry in the specified proportions until the colour of the mixture is uniform. Approved water shall be added sparingly, only the minimum necessary being used to produce a workable mixture of normal consistency. The water /cement ratio shall not exceed 0.50 by weight unless directed otherwise by the Contract Officer Representative (COR). All mortar shall be machine mixed or hand mixed on approval by the Contract Officer Representative (COR).

3.3 Mortar shall be mixed in such quantities as can be used the work within 30 minutes after mixing with water. Mortar which has taken initial set shall be not be used nor shall it be remixed with fresh mortal, and such mortar shall be discarded.

5.0 INSTALLATION AND WORKMANSHIP

5.1 Brick masonry work shall be built to dimensions indicated on the drawings, plumb, curved or battered, as required, by skilled masons and workmen properly supervised. Brick shall be thoroughly washed and soaked in water for at least 4 hours before use.

5.2 All joint vertical or horizontal shall be filled with mortar Horizontal joint shall be parallel, level & straight; vertical joint in alternate courses shall be directly over one order. Joint thickness shall not be less than 6mm & not more than 10mm. The height of four bricks shall not exceed 300mm.

5.3 Joint of exposed brickwork shall be raked & concave pointed or as shown in drawing or specified elsewhere. The surface of the exposed brick work shall always be kept clean & free from mortar stains. A wooden template shall be used uniformity of the joint thickness.

5.4 Where new work joins previous work, the latter shall be well cleaned and thoroughly watered. All face work bricks shall be specially selected regarding size, shape and edges. Brick for 250mm walls, shall be laid in stretcher Bond, or as shown in drawing or directed by Contract Officer Representative (COR) with frogs (Manufacturer's trademark) mark upward. Brick for 225mm walls shall be laid in common bond.

5.6 Height of brick work for a day- work shall be limited to 1200mm for and 250mm wall

5.6 All embedded metal items shall be installed as the masonry work progresses. Locations shall be indicated on the drawings.

5.7 All brick work shall be thoroughly cured for at least 7 days or as directed by the Contract Officer Representative (COR).

6.0 METHEOD OF MEASUREMENT

Measurement shall be made in cubic meter (cum) for wall with 10" thickness & in square meter (sqm) for 5" walls or as shown in schedule of work. Payment shall be made for complete work.

BRICK FALT SOLING

1. SCOPE OF WORK

The work covered by this item shall consist of supplying and laying brick on top of the earth sand bed or any where as shown in the drawing.

2. DESCRIPTION OF WORKS

Bricks shall comply with requirements of first class brick unless otherwise Contract Officer Representative (COR). The blinding sand will have F.M:1.5 and shall be lean, free from organic matters. Brick shall be laid flat in surface to surface contact with adjoining bricks and there joints shall be filled with sand. The sand shall be brushed in until joints are filled. Flushing of sand of sand with water will not be done unless permitted.

3. METHODS OF MEASUREMENT

Brick soling shall be measured by the square meter in place.

DAMP PROOF COURSE (DPC)

1. SCOPE OF WORK

The work covered by the item shall consist of constructing on top of foundation wall or any where as shown in drawing a damp proof course installed in place using 1:4 cement mortar 0.05 mm PVC sheet.

2. DISCRIPTION OF WORK

2.1 D.P.C shall extend the full width of the plinth walls unless otherwise by the plans and shall be laid only after the levels of the plinth have been checked.

2.2 Damp proofing membrane shall consist of o.o5 mm transparent P.V.C sheet & shall be laid in between 6mm layers of cement sand mortar in 1:4 proportion unless otherwise shown in drawing. Laps shall be less than 150mm and shall be drawing together with Aica, Aibon or any approve adhesive flashing shall be hold back at least 6mm from the outer face of brick external walls. At plinth level the membrane shall hang vertically equal to floor slab thickness the interior sides as detailed in drawing. The DPC shall be cured at least 7 days.

3.0 METHOD OF MEASUREMENT

Measurement shall be given in square meter basis for actual work.

PLASTERING WORKS

1.0 **SCOPE OF WORK**

The work to be performed under the section includes cement plaster on brick or concrete surface for protection for protection and appearance as shown and noted on the drawings and as specified.

2.0 DESCRIPTION OF WORK

2.1 Plastering shall be performed in a neat, true and workman like manner. Corners shall not be rounded or beveled, unless directed by the Contract Officer Representative (COR). All intersections, edges and corners shall have sharp edges, unless otherwise directed, and shall be at right angles. Lines shall be straight and true.

2.2 Unless specified otherwise, cement plaster shall be used to the following proportion. On brick walls, one part Portland cement to six parts sand; on concrete surface, one part Portland cement to four parts sand by weight or by volume, but either method requires approval of the Contract Officer Representative (COR).

2.3 Before starting plaster work, brick joint shall be raked out to a depth of 6mm and concrete surfaces shall be roughened. Both brick on concrete surface shall be cleaned to remove loose materials shall be thoroughly dampened with water.

2.4 Thickness of cement plaster for brick surface will be min 12mm and that for R.C.C. surface will be min 6mm. The F.M of Sand will be 1.50 unless otherwise specified. Mortar shall be mixed in such quantities as can be used in work within 30 Water cement ratio for mortar's mix shall not be more than o.5.

2.5 All plaster shall be kept moist throughout the progress of the work, and for a list 10 days thereafter. If cracks or blemishes appear through negligence or due to other reasons, the defects shall be rectified by the Contractor at his own expense.

2.6 Plaster shall be floated and toweled to true and plumb surface and tested frequently during the progress of the work with a straight edge sufficiently long. There shall be no overlaps or construction joints in single unbroken surface unless its size is over 300 square feet and prior permission is received from the Contract Officer Representative (COR). Plaster shall be stopped only at corners, sides, construction or expansion joints.

3.0 METHOD OF MEASUREMENT

Measurement shall be made square meter basis of covered area

ARITIFICAL PATENT STONE ON ROOF

1. ARITIFICAL PATENT STONE WORK

1.1 **Scope of work:** The work consist of installation of finishing layer of cement concrete over roof.

Materials shall be as follows :

a.	Cement	: Portland cement conforming to ASTM Specification C150, Type -1.
b.	Sand	: Clean, twice washed river sand. Minimum fineness modulus (FM) not less than 2.50
c.	Coarse Aggregate	: Clean, twice washed 9mm done broken Stone/Aggregate Pea Gravel or picked jhama chips as specified in the Schedule of item of Works.

1.2 Approval : Before proceeding with the work a sample panel of artificial patent stone flooring shall be prepared as specified for approval of the Contract Officer Representative (COR).

1.3 **Preparation :** The roof over which the artificial stone will laid shall be thoroughly cleaned and washed ,removing , dust, dirt and other foreign matter to the satisfaction of the Contract Officer Representative (COR).

1.4 Following the preparatory work, the slab shall be thoroughly wetted with clean water by pounding for at least overnight. All excess water shall be removed ahead of the application of the bonding slurry so that the concrete surface is uniformly damp but not glistening wet.

1.5 A creamy bonding slurry of neat cement shall be supplied and well scrubbed into the surface with stiff bristle brushes. Only as much bonding slurry shall be mixed and applied will be covered by the succeeding coat before the slurry dries out.

1.6 The method of measuring materials shall be such that specified proportion of the materials can be control and accurately maintained. Shovel Measurements will not be allowed. All constituents shall be thoroughly mixed. No re-tampered materials and no materials which has partially set shall be used in the work

1.8 The mixture shall be thoroughly temped by hand. The compaction shall be followed by steel toweling (after the excess water has dried surface is still damp but not glistening wet) to bring the finish to a smooth, hard surface free from marks and imperfections of any kind. Dusting with dry cement or sprinkling with water will not be permitted in finishing. Finished surface must be kept clear of dust, dirt or clay stain and shall be of uniform colour all over.

1.9 The temporary dividers may be metal strips or wooden battens of true line and space. The top of the drivers shall be perfectly leveled with level of with the finished floor desired.

1.10 The sequence of filling in the panels shall be on ”Checker Board” plan. The casting of the complementary be shall be done at least 48 hours after the first set is cast and dividers removed.

1.11 The top shall be moist cured for at least 7 days. The flooring shall not be subjected to moderate use before 14 days and to severe use before 28 days.

2.0 INSTLATION

Patent stone floor shall be made at places and location as shown in drawing or in finish Schedule.

3.0 METHOD OF MEASUREMENT

Measurement shall be made square meter basis of covered area

PAINTING

1.1 Scope of work: The item covers application of approved paints over surface (masonry, wood and steel) in min 3 coats or as specified by manufactures in a number to guide an even, smooth finish of confirm shade will at any mark of brush & joint.

1.2 Before purchasing materials, the Contractor shall submit to the Contract Officer Representative (COR) a list showing the band and type of paints proposed for the work indicating items receiving different kind of paint. Manufacture's catalogue , date or specification sheets, in triplicate for materials selected shall be submitted to the Contract Officer Representative (COR) with the list of bands and types. No materials shall be used without approval of the Contract Officer Representative (COR).

1.3 All painting materials shall be for best quality and be delivered to the site in unopened original containers bearing manufacturers labels.

1.4 Materials to be used in the work shall conform to reputed manufactures specification and to the satisfaction of the Contract Officer Representative (COR).

2.0 **SURFACE PREPARATION**

2.1 On plastered concrete & masonry surface.

2.2 All surface to be painted shall be thoroughly cleaned and be free from of all grit, grease, dirt, loose materials, mortar dropping and the like.

2.3 It shall be sanded smooth and made free of marks before applying the first coat.

2.4 Voids and holes shall be filled after first coat is dry using filler compatible with the finishing work.

3.0 APPLICATION

3.1 No work shall be done under conditions which are unsuitable for the production of good results. All spaces shall be broomed clean before painting or finishing is started.

3.7 The workmanship shall be the best. All paint shall be applied with brushes/ rollers under adequate illumination, evenly spread, smoothly flowed on without runs or sage. Paint shall be worked into all corners and crevice.

3.8 Materials shall be applied in strict accordance with the manufacturer's directions, and in particular, on prepared paint shall be thinned in any way except as directed by manufacturer. All paint shall be thoroughly mixed before being used.

3.9 Each coat applied must be inspected and approved by the Contract Officer Representative (COR) before the application of the succeeding coat. Otherwise on credit for the coat applied will be given and the Contractor may have to repeat the work in question it his own expense. The Contractor shall notify the Contract Officer Representative (COR) when each coat is ready for inspection.

3.10 No exterior painting shall be done in rainy, damp weather unite the surface is thoroughly dry. No interior painting will be done on Damp surface.

3.11 Minimum drying shall not be less than 72 hours between coats for exterior paints and 48 hours for interior coat paints. Each cot shall be thoroughly dry before application of subsequent coat.

4.0 Any damage to adjacent work caused by paint or painting operations shall be rectified by the Contractor at his own expense.

5.0 **COMPLETION**

4.1 At completion of painting work, the Contractor shall remove any paint spots and stains caused by work under this section from, floors, walls, glass, hardware, equipment and other surface leaving these surface in perfect condition.

4.2 The Contract Officer Representative (COR) will conduct finial inspection of all work under this section and the Contractor shall repaint or retouch at directed by the Contract Officer Representative (COR) any surface which do dot comply with the requirements of these specifications or which have been damaged constriction work. All surface finished under this section shall be left in perfect condition, free of defects and blemishes.

3.4 All rubbish and accumulated painting materials shall be removed from the premises.

5.0 METHOD OF MEASUREMENT

Measurement shall be made square meter basis of covered area.

NEAT CEMENT SKIRTING/DADO

1. **SCOPE OF WORK**

This item shall consist of providing 12mm thick neat cement finished skirting/Dado on a 1:4 cement-sand mortar under bed on walls or where necessary accordance with these Specifications.

2. **GENERAL**

Materials shall meet requirements as stated in Masonry work.

2.1 Wall plaster, if any, shall be removed along the floor to the required height and the surface shall be thoroughly scrubbed and wetted before Appling the under bed. The second under root shall have a nominal thickness of 6mm and the total built-up thickness will be same as that of the plaster on the wall. A 1/8 inch deep grove shall be formed where skirting/Dado meets wall plaster.

2.2 The skirting/Dado shall be installed flush with the finished wall surface. The intersection with the floor shall be at right angle and the top of the skirting/Dado shall be straight and sharp.

2.3 The under bed shall be laid as uniformly as possible and allowed to become firm before scratching for key and subsequently allowed to become thoroughly dry before applying the second undercoat. A net cement paste 3mm thick shall be spread evenly over the second coat and shall be steel toweled under firm pressure to produce a drench uniform smooth surface free from trowel marks.

2.4 The work shall be cured and protected from weather, for atleast10 days immediately following the installation.

3.0 METHOD OF MEASUREMENT

Measurement shall be made square meter basis of covered area.

ELECTRIAL INSTALLATION

1. SCOPE OF WORK

This item covers all operations with internal and external electrification works to connect to the electrical mains as indicated on the drawings. All work shall be completely in conformity with the Rules and regulations of the concerned Authorities.

2. GENERAL REQUIREMENTS

The drawings indicated the general arrangement of the electrical installation. Details of proposed departures due to actual field condition or other pause shall be submitted w2ith the Consultant recommendation to the Contract Officer Representative (COR) for approval. The Contractor shall carefully examine the drawings and shall be responsible for the paper installation of materials, fixture and equipments in each unit as indicated, without substantial alteration.

2.1 **Regulations:** The installation in general shall be carried out in conformity with the Electricity Rules of the Govt. of Bangladesh (India Electricity Rules and Act as adopted in Bangladesh) and the latest edition of the wiring regulations of the institute of electrical Engineers (London), (Except that the light and fan points shall not be earthed), hereinafter referred as "I.E.E. Wiring Regulations" and the British Standard Code of practice for the relevant works. But where the undernoted specification differs from these rules and standards, the specification written hereunder shall be followed. Any special requirement of the electrical Inspector, Government, of Bangladesh or the power Development Board or the Telegraph and Telephone Development, Government of Bangladesh or the other legal authority shall also be complied with at no extra cost to the employer.

2.2 Climatic and Atmospheric Conditions: The installations, equipments and materials shall be installed both externally and internally and shall therefore, be designed and built to give efficient and reliable service continuously at the normal voltage and current rating in the prevalent climatic and atmospheric conditions at the relevant site.

2.3 Specifications: Material required which are not covered by the detailed specifications shall be as recommended by the equipment manufacturer or consistent with good practice and approved by the Contract Officer Representative (COR).

2.4 Drawing: The drawing show the general arrangement of all circuitry, wiring, feeders, cables and race ways, etc., however, where local conditions necessitate a re-arrangement, the Contractor shall prepare and submit for approval, drawings of the proposed rearrangement. Because of the scale of the drawings it is not possible not to indicate all offsets, fitting and accessories which may be required. The Contractor shall carefully investigate the structural and finish conditions affecting all of his works and shall arrange such works accordingly, furnishing such fittings, access traps, inspection boxes and accessories as may be required to meet such conditions. The Conductor shall prepare a shop drawing indicating the exact location of conduits and wiring for approval of the Contract Officer Representative (COR) prior to installation.

2.5 Cutting and Repairing: The work shall be carefully laid out in advance and any cutting of construction shall be done only with the written permission of the Contract Officer Representative (COR). Cutting shall carefully done and damage to the building as a result of cutting for installations, piping, wiring for equipments, shall be repaired by skilled materials of the trade involved, at no additional expense to the employer.

2.5.1 Protection of Fixture : Fitting, Materials and Equipment:

Conduit and pipe opening shall be closed with caps of plugs during installation. Fixture fitting equipments shall be adequately protected against dirt, water and chemical or mechanical injury. At the completion of the work fixture, materials and equipments shall be thoroughly cleaned and delivered in a condition satisfactory to the Contract Officer Representative (COR)**.**

2.3. APPROVAL AND LIST OF MATERIALS, FIXTURE AND EQUIPMENT

As soon as practicable and within 30 days after date or receipt of executed contact and before any materials fixtures or equipment are purchased, the contractor shall submit to the **Consultant** for approval a complete list, in triplicate, of materials, fixtures and equipment to be incorporated in the work, together with the names and addresses of the manufactures and there catalogues/ numbers and tread names with a forwarding letter. The Consultant will send the same with there recommendations to the Contract Officer Representative (COR) For final approval. The Contractor shall also furnish other detailed information where so directed, under the various items. No consideration will be given to partial lists submitted from time to time. Approval of materials will be based on manufacturers published ratings. Any materials, fixture and equipment listed which are not in accordance with the specification requirements may be rejected. The product of any reputable manufacturer regularly engaged in the commercial production of equipments will not be excluded on the basis of minor differences, provided all essential requirements of this specifications relative to materials, capacity and performance are met. The Contractor shall furnish a statement giving a complete description of all points wherein the equipment be proposes to furnish does not comply with the specifications. Failure to furnish such a statement will be interpreted to mean that the equipment meets all requirements of specifications. Tear sheets of catalogue shall be furnished if such catalogues are not readily available to the Contract Officer Representative (COR)**.**

2.4. MATERIALS AND EQUIPMENT

2.4.1 Wires and Cables

2.4.1.1 Wires and cables for installation in raceways for operation at less than 600 volts shall be of soft copper properly refined and shall have a minimum conductivity of 90% with PVC insulation.

2.4.1.2 All cable insulation, except as specifically noted elsewhere shall be rated for 600volts and conform to B.S.S. specification.

2.4.2 Conduits

2.4.2.1 UPVC pipe must conform to "E" class RFL/National Polymer brand (approved brand) designed for concealed installation in slabs, walls, columns etc. These shall be heavy well rigid type. The minimum dimension shall be as herein under-

Size	OD	ID	Wall thickness	
19mm	26.9mm		2.5mm	
25.mm	33.8mm		2.7mm	
38.mm	48.4mm		3.7mm	

No PVC fitting shall have wall thickness any point lesser than that of the pipe. The color shall be grey except otherwise stated.

2.4.3 Junction Box, pull Box and Circular Box:

All boxes and fitting shall be manufactured from PVC copolymer material. The boxes shall be fitting so designed and constructed as to withstand rough use as may be expected during and after installation. The inside and outside surfaces of the fittings shall be smooth; clean and uniform and free from projection and other defects.

The interior of boxes and fitting shall be free from obstruction which might cause abrasion to cables or interfere with the introduced and withdrawal of cable to be enclosed within the pipe. The inside edge of all openings through which cables are intended to pass through shall be smoothly rounded in order to prevent any damage to the cable.

2.4.4 Switches

2.4.4.1 The switches shall be in accordance with B.S.S. Part-1, 1964 as amended to-date.

2.4.5 Panel Board

2.4.5.1 Panel boards shall consist of a factory completed dead front assembly of back pan, main buses, over current and switching units, 18 SWG. Thick sheet metal cabinet and trim.

2.4.5.2 Bus bars for panel board mains shall be of copper, size for the indicated capacity in accordance with the Underwriter/laboratory Standards.

2.4.6 Distribution Board

2.4.6.1 Distribution boards shall be of safety type with double pole/ there pole isolator or circuit breaker, operate able on a 4oo/230 volts 3-phase, 4-wire system conforming to B.S.S.214 as amended to-date.

2.4.7 Fixtures, Fitting and Appliances

2.4.7.1 All electrical fixtures, fittings and appliances including accessories shall conform latest B.S.S. regulation No. 301 and as amended to-date.

2.5 GENERAL INSTALLATION REQUIREMENTS

2.5.1 Concealed Installations

2.5.1.1 The conduit shall be completely concealed in the walls, columns, R.C.C. slabs, floors and nicely finished. The conduits are to be continued between all floors and access shall be provided by access traps or inspection boxes made of cast iron or steel, as required at such places and as recommended by I.E.E. Regulation and approved by the Contract Officer Representative (COR).

2.5.1.2 Where conduit is shown on the drawings or is otherwise specified as being concealed, such conduit may be embedded in structural slabs or in concrete fill laid on top of structural slabs, or concealed within hollow spaces. Where embedded in structural slabs conduits shall not exceed 38mm trade sizes unless there are specific identification to the contrary. In areas where the slab is less than 12mm thick, the overall diameter of the largest conduit shall not exceed one third of slab thickness.

2.5.1.3 All the conduits running through the boxes and columns shall be laid with the innermost reinforcement case with suitable effect in conduit so to make the outer surface of junction box cover for switch box edge flush with the finished surface level or beam of columns as approved.

2.5.1.4 All conduit running through slab-beams, slab-column and slab-wall junction shall be connected through a bend and junction box provided with offset, if necessary, to make the outer surface of the junction box cover flush with the finished surface.

2.5.1.5 Care shall be taken when making concealed installation to see that adequate clearance is provided over the thickness elements, such as coupling etc. So that fill or architectural finishes may be applied which will be smooth, flat not subject to sapling or cracking.

2.5.1.6 Raceways runs embedded in slab shall be spaced not less than three outside diameter center to center unless they are so co-ordinate with the structures as not cause weakness.

2.5.2 Exposed Installation

2.5.2.1 Raceways or other wiring methods shall be run exposed only.

a. In specially assigned electric riser closets, shafts or switch board room.
b. In mechanical equipment spaces.
c. Where specially indicated on the drawing or otherwise, with the expressed permission of the Contract Officer Representative (COR)**.**

2.5.2.2 Exposed raceways of other wiring method shall be run parallel to building walls, column lines, etc. throughout.

2.5.2.3 All exposed heavy conduits are to be fastened to masonry walls, floor or partitions, use of wooden plug will not be permitted instead rowel plough should be used.. Metal saddles of approved type not more than 600mm apart , shall be used for fixing exposed conduit.

2.5.2.4 Composition supports of cables installed in vertical raceways shall be provided where indicated on the drawings and as otherwise necessary to meet code requirements.

2.6 Routing

2.6.1 Every effort shall be made to route raceways or other wiring so as to prevent wiring from being subject to high ambient temperature condition. Minimum clearance from heated pipes, ducts or surface such as breechings, flush, etc. shall be maintained as follows:-

a.	Crossing un-insulated pipes or ducts	-75mm
b.	Crossing insulated pipes or ducts	-25mm
c.	Running parallel to un-insulated pipes, ducts or surfaces	-900mm
d.	Running parallel to insulated pipes, ducts or surfaces	-150mm

2.6.2 Raceways of any routing shown on the places, raceways or other wiring method shall not run exposed over a boiler or embedded in construction under a boiler, unless special provisions for wiring through these specific high ambient temperature areas have been indicated.

2.6.3 Raceways or other wiring methods run in suspended ceiling may be installed as the draw files, except that, where such raceways, etc. and being installed prior complete information regarding the final layout of all trade occupying the suspended celing plenum, they shall be installed in a co-ordinate “Square manner so as to minimize future conflicts.

2.6.4 Under no condition raceways or other wiring method be installed in elevator shafts and hoist ways. Where outlets are being provided for such items as tri cables, pit lights, run by lift, etc. only the outlet boxes themselves shall be located within the confines of the staff.

2.7 Miscellaneous Requirements

2.7.2 The installation of raceways or other wiring methods requiring the notching, cutting of structural elements shall be co-ordinate with the other trades, to ensure that no weakening of the structure is caused.

2.7.3 Except as otherwise noted in raceways intended for the pulling or wires or cables, no more than four 90^0 bends will be permitted between outlets boxes, pull boxes or other points.

2.7.4 When fishing or snaking raceways to set up for pulling in wires and cables, fish tapes means shall be used.

2.8 Wires and cables shall not be pulled into raceways until:-

a. The project has procedures which are not likely to injure electrical wires or cables.

b. The project has progressed to a point where raceways are dry and moisture is no longer likely to get into them.

c. Wires or cables shall be pull into raceways utilizing a suitable brush, followed by and 85% diameter ball mandrel ahead of the wires cables in the pulling assembly.

2.9 WIRING METHODS

2.9.1 General wiring methods permissible for the various parts and elements of the system operating at 600 Volts or less shall be as hereinafter specified.

2.9.1 Rigid standard weight metalled conduit shall be used for feeders and sub-feeders and appliance branch circuiting throughout.

2.9.2 Rigid standard weight metalled conduit shall be used for lighting and appliance branch circuiting throughout.

2.9.3 Where non flexible wiring methods are specified it shall be understood that the following exceptions are to be made for final connections without claiming any extra cost.

a. Final connections to motors and motor operated equipment, shall be made with 38mm of flexible metallic conduit.
b. Final connections to recessed lighting fixtures shall be made with not more than 500mm long flexible metallic conduit or flexible wire.

2.10 SURFACE WIRING

2.10.1Conduit for surface wiring shall be secured with wall ceiling or any other structure by means ofddle at a of 600mm c/c, and all the bends will be made by mechanical bender. No elbows will be allowed. Where necessary pull boxes of Inspection Boxes as specified shall be used.

2.10.2 Surface wiring on batter will be seasoned garjan/ Chittagong Teac wood properly secured to the wall or ceiling by royal plug. Batten shall be fixed on proper alignment with the ceiling and walls.

2.10.3 Brass link clip shall be fixed to the batten to hold the wire @ 100mm c/c.

Twin core cable with E.C.C. of proper grade shall be used without making any joint between switch board and individual outlet. The switch shall be on phase wire not on neutral wire.

2.11 SWITCH

2.11.1Furnish and install all wiring devices as shown on the plans and as hereinafter specified. Switches for lighting control in rooms having single door entrance shall be located at striking of the door regard less of their position on the plans.

2.11.2The switch shall be in accordance with B.S.S. 1299 Part-1, and shall be flush or surface as mentioned. The switch shall be finished in colour approved by the Contract Officer Representative (COR)**.**

2.11.3 3-pin 5 amp. Sockets shall be switched and shuttered and recessed type suitable for concealed mounting and will be suitable for fixing flushed plugs.

2.12 INSTALLATION

2.12.1 Cutting of conduits shall be done with a hacksaw in a neat manner without damage to the conduits.

2.12.2 The ends of all conduits shall be carefully reamed out free from burrs before instillations and after threading.

2.12.3 The ends of all conduit entering a junction box, cabinet, etc. shall be provided with two brass lock nuts and male/female brass bushing of required size, for 31mm dia conduits and larger ones, installed bushing shall be used.

2.12.4 If bushing is of fully insulated type, an additional look nut shall be used inside the junction box and cabinet before installing the bushing.

2.12.5 Conduits entering main distribution feeder pull boxes shall be provided with insulated bushing regardless of sizes.

2.12.6 Care shall be taken to that all conduits run from a permanent and continuous ground return back to the service ground connection point. Conduits used on system which are entirely isolated from the light and other distribution system shall be electrically continuous grounded in a approved manner.

2.12.7 Where conduits terminate at equipments or location where a ground bus provided, such as main boards (or pull boxes), sub- station transformer vaults , etc. grounding bushings shall be provided for each conduits. Such bushing shall be bounded to the ground bus by a 8 SWG. Dia (Min.) wire.

2.12.8 Conduits, exposed or embedded crossing building expansion or construction joints shall be furnished with approved brass expansion fitting and shall be provided with approved flexible grounding bonds by passing the fittings.

2.12.9 Wherever exterior underground conduits enter the building through sleeves or openings in walls they shall be securely and permanently plugged by means of approved sealing compound.

2.12.10 During installation of conduits, all unfinished runs, and also termination in pull boxes, cabinets, etc. shall be capped in an approved manner. Caps in cabinets, etc. shall be left in place until building is ready for installation of conductor. Paper or wood plugs shall not be use for this purposes.

2.12.11 The conduits system shall be self-ventilating type and drainage outlets shall be provided at points in the installation, where condensed moisture might cool, as per standard practice of the electrical trade.

2.13 **JOINTS**

2.13.1 Conduits shall be coupled by means of running threads. Thread less coupling shall not be permitted. All joints shall be made up tight.

2.13.2 Where it is impossible to turn the conduit in coupling section together, a Brickson type coupling shall be used.

2.13.3 Where conduits is to be embedded in concert, threads shall be coated prior to coupling or making up with red leads.

2.14 **FLEXIBLE METALLIC CONDUIT, FITTING AND CONNECTIONS**

2.14.1 **Conduiting**

2.14.1.1Flexible metallic conduit shall be galvanized steel conduit it all respect conforming to the latest underwriters Laboratory Standards.

2.14.1.2 The minimum size of flexible conduit-permissible for the various parts and elements of the electrical work shall be 25mm throughout except otherwise specified.

2.14.2 **INSTALLATION**

2.14.2.1 The ends of the flexible conduit shall be carefully reamed our free from burrs-before installation.

2.14.2.2 All cuts shall be made squire and shall be done with hacksaws.

2.14.2.3 Termination of flexible conduit shall be continuous between terminations without the use of coupling.

2.14.2.4 Rounds of flexible conduit shall be continuous between terminations without the use of coupling.

2.14.2.5 Flexible conduit shall not be bents so not its radius is less than five times the trade sizes.

2.15 JUNCTION AND PULL BOXES

2.15.1 Where indicated in the drawings and specifications or where necessary for compliance with code requirement for cable installation, junction and pull boxes of the proper sizes shall be provided.

2.15.2 Junction and pull boxes shall be manufactured from 18 SWG.(Min.) thick sheet steel or molded cast iron and shall be furnished with flat screwed covers.

2.15.3 Where boxes are set flush in walls and ceiling, cover screws shall be flat head type and properly counter sunken. Cover shall be arranged to completely cover openings in buildings finish.

2.15.4 Where suitable standard outlet boxes may be used as junction and pull boxes.

2.15.5 If required by the building constriction, junction and pull boxes of special sizes and shapes determined from filed measurement shall be provided in order to make neat installations.

2.15.6 Should the utility company or may other agency require are carries between groups or feeders in pull boxes, they shall be provided at no additional cost.

2.15.7 If feeders and other wiring following the same routing are indicated on the plans as running through separate pull boxes, it shall be understood that is intended to maintain a segregation of the wires and cables. Separately indicated pull boxes may be in corporate into single boxes, only on condition that segregation is maintained by means of approved asbestos carriers.

2.15.8 Pull boxes having any single horizontal dimension larger than 150mm shall be filled with cable support racks consisting of 19mm diameter steel pipe with flanged ends bolted to the sides or frame of the pull boxes. Each pipe support shall be filled with a continuous fiber insulating sleeve.

2.15.9 Where a junction or pull box in installed in a furred ceiling or space, and where due to building finish, the sheet metal cover of the pull box exposed to view is not acceptable, on approved access panel with suitable frame and supports in the furring in front of the pull boxes cover shall be provided.

2.16 OUTLET BOXES

Outlet boxes shall be provided as hereinafter specified, where shown on the drawings and locations where required. When installation outlet boxes particular attention shall be paid to the following.

2.16.1 Outlet boxes shall be of such size and depth as to allow for easy wire pulling and installation of wiring devices, and shall comply with code minimum capacity requirements.

2.16.2 All mild sheet steel and cast boxes shall have suitable knockouts.

2.16.3 All cast boxes shall be provided with properly drilled and tapped holes.

2.16.4 There shall no more holes in any outlet boxes than required for the circuitry entering the same unused opening in boxes shall be provided with approved cast threaded plugs.

2.16.5 The sheet steel boxes shall have threaded cars for fixing the covers.

2.16.6 Sheet steel boxes used for flush outlet in walls or partitions shall be set such that no more than 3mm exists between the front edge of the boxes and the near surface of the device plates which will be finally installed.

2.16.7 Sheet steel boxes and covers shall be hot-dipped galvanized and cast iron boxes and cover shall be electro- galvanized.

2.16.8 In case of non-availability of galvanized sheet steel outlet boxes 18 SWG. Thick M.S. sheet made outlet boxes – spray painted with two coats of synthetic enamels paint over a prime coat may be accepted subject or prior approval of samples by the Contract Officer Representative (COR)

2.16.9 In case of non-availability of C.I. circular boxes may be accepted subject to prior approval of samples by the Contract Officer Representative (COR).

2.17 WIRE AND CABLES INSTALLATION

2.17.1 Wiring: Wires and cables for installation in conduits/ raceways for operation at less than 600 volts and shall conform to the following.

2.17.1 Conductors shall be of soft copper properly refined and shall have a minimum conductivity of 90% with PVC insulation.

2.17.2 All wires and cables insulation except as specifically noted elsewhere, shall be rated for 600 volts and shall conform to B.S. Specification.

2.17.3 All portion of electrical system utilizing PVC insulated conductors shall be guaranteed against grounds, shorts and other insulation failures for a period 5 years regardless of any other indication, with regard to the guaranteed period for electric work.

2.17.4 Wires and cables shall be delivered to the site of the project original packaging or in factory reels, fully identified with stage or levels, indicating the manufacturer' name and the date of manufacture.

2.17.5 Wires and cables bear repetitive marking along the entire length of there outer covering, indicating conductor size, insulation type, voltage rating etc. as necessary for compliance with code requirements.

2.17.6 The outlet covering of wires and cables shall be colour coded means of factory applied approved code methods so as to provide a clear differentiation between each phase and neutral. The phase and neutral shall be coloured red, yellow, blue and black respectively. In case of single phase two wire system red, yellow or blue shall be for the phase line and black for neutral.

2.17.7 All wires shall be of standard construction.

2.18 **INSTALLATION**

2.18.1 The maximum number of conductors in any conduit shall be as per drawing conforming with the regulations of I. E.E. No joints in the conductor will be made throughout the installation and lopping system shall be following.

2.18.1 The conductor shall be tested for continuity and insulation before energizing and conform to the standard laid down by the local Engineering Authority and Installation of Electrical Engineer (England).

2.18.2 Generally, single core cable (non-sheathed) is to be installed in metal conduits. The conduits sizes shall be as specified in the drawings. It must be ensured that the cables are not damaged during pulling. For long lengths, pull boxes must be used even if not indicated in the drawings. Cables shall not be drawn round more than two 90^0 bend between drawing-in-boxes and any single bend must not be less than 90^0 .

2.18.3 The cables upto $25mm^2$ shall be solid conductor and therefore, jointing is to done through porcelain connector and the connection shall be wound with PIB tape before placing in the boxes. Termination of cables upto $25mm^2$ shall be done by making a hook at the end and for higher sizes, brass cable termination must be used. Tee-off joints in the cables to lighting point, switches , etc. should not be made. Looping in system of wiring is to be followed for recessed and surface wiring and the joints are to be made in the switch boards only. All 3 to 4 core PVC cable shall be terminated using brass cable glands of paper size.

BILL OF QUANTITY FOR CONSTRUCTION AND COMMISSIONING OF WATER WELL AT ANNEX COMPOUND US EMBASSY, BARIDHARA, DHAKA.

SECTION 01: ITEMS FOR TUBE WELL INSTALLATION AND COMMISSIONING

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
2	**Production Well Drilling & Construction:**				
2.1	**Mobilization :** Preparation, transportation and mobilization of complete drilling equipment and plants, construction components to the work site and demobilization, re-transportation, clearing the site after completion of work, etc. All complete as per specification and direction of the Contract Officer Representative (COR).	L.S.	1		
2.2	**Drilling of Production Bore Hole :** Execution of production well boring by reverse circulation or rotary method as per specification and direction of the Engineer. The dia of bore hole shall be minimum **400**mm.				
2.2.1	From 0 m to 50 m	Rm	50		
2.2.2	From 50 m to 100 m	Rm	50		
2.2.3	From 100 m to 165 m	Rm	65		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
2.3	**Installation of Well Components :** Supplying and installation of the following Tube Well fixtures at working site as per standard practice and direction of the Contract Officer Representative (COR).				
2.3.1	**Outer Casing/ Housing Pipe** shall be **300** mm nominal dia and shall be standard weight black steel pipe, conforming **ASTM A 53** or steel pipe conforming to **AWWA C 200.** Joint shall be both threaded and coupled or field welded in accordance with **AWWA C 206.** All casing shall be provided with drive shoes. All complete as per specification and direction of the Contract Officer Representative (COR).	Rm	15		
2.3.2	300 mm dia M.S. **cap** having 6mm thickness for housing pipe covering.	Each	1		
2.3.3	**Inner Casing/ Blind Pipe** shall be **150** mm nominal dia and shall be standard weight black steel pipe, conforming **ASTM A 53** or steel pipe conforming to **AWWA C 200.** Joint shall be either threaded or coupled or field welded in accordance with **AWWA C 206.** All casing shall be provided with drive shoes. All complete as per specification and direction of the Contract Officer Representative (COR).	Rm	150		
2.3.4	**Strainer** shall be 150 mm nominal dia and shall be standard weight black steel pipe, conforming **ASTM A 53** or steel pipe conforming to **AWWA C 200.** Joint shall be either threaded or coupled or field welded in accordance with **AWWA C 206.** All casing shall be provided with drive shoes. All complete as per specification and direction of the Contracting Officer Representative (COR). Thickness of pipe 4.8 mm(minimum), Opening area limited to 15% to 22%, Width of slot 0.4mm/400micron (Maximum)	Rm	15		
2.3.6	**Centralizer** made of 3 mm dia M.S. rod fixed at an interval as specified.	Each	150		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
2.3.7	150 mm dia G.I. **bail plug**	Rm	5		
2.3.8	150 mm dia and 6mm thick M.S. cap for **blind pipe /sand trap**.	Each	1		
2.4	**Production Well Installation and Testing :**				
2.4.1	**Installation of Tube well** Complete installation of 150 mm dia deep tube well fixtures such as expanded top pipes, housing pipes, strainer, blind pipe, pipe cap etc. with fitting & fixing, welding and placing in position etc. All complete as per standard practice and direction of the Contract Officer Representative (COR) including supply of all necessary materials and equipment in the field.	Rm	165		
2.4.2	**Verticality and Alignment Test :** Checking of verticality and straightness of well casing by provided the required equipment as per specification and direction of the Contract Officer Representative (COR).	L.S	1		
2.4.3	**Gravel Shrouding:** Preparation and making gravel pack around the tube well fixtures with supply of designed graded pea gravels free from any substance harmful to pipe and health confirmed by test (Passing through 10 mesh and retained on 40 mesh) including sieving, washing etc. All complete as per direction of the Contracting Officer Representative (COR)	cum	14		
2.4.4	**Cement Grouting** Grout shall consist of Portland cement conforming to ASTM C 150, Type I or II, sand and water. Grout shall be proportioned not to exceed 9 liters of water per 0.3 cubic meters of cement, with a mixture of such consistency that the water well can be properly grouted. Not more than 3 percent by weight of bentonite powder may be added to reduce shrinkage.	cum	1.5		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
2.4.5	**Development the Well:** After construction, the water well shall be developed in accordance with the drilling plan. The Contractor shall develop the water well by such methods approved until the water pumped from the water well is substantially free sand. Developing equipment shall be of approved type and of sufficient capacity to remove all cutting fluids, sand, rock cutting, and any other foreign material. The water well shall be thoroughly cleaned from top to bottom before beginning the water well tests. All complete as per standard practice and direction of the Contract Officer Representative (COR).	LS	1		
2.4.6	**Capacity Test :** The contractor shall furnish and install an approved temporary test pump, with discharge piping of sufficient size and length to conduct the water being pumped to point of discharge, and equipment necessary for measuring the rate of flow and water level in the water well. A continuous 12 hours capacity test shall be run with the pumping rate and drawdown at the water well and recorded every ½ minute during the first 5 minutes after starting the pump; then every 5 minutes for an hour; then every 20 minutes for 2 hours. From this point on, readings taken at hourly intervals are sufficient. No observation wells are available therefore all water levels must be taken in the water well being tested to determine drawdown depths. The test shall begin at the rate of the expected capacity of water well and at least that rate maintained throughout the duration of the test. If this capacity cannot be maintained for the test period, the contractor will terminate the capacity test and notify the Contract Officer Representative (COR) for direction.	LS	1		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
2.4.7	**Test for Quality of Water:** When the drawdown or capacity tests have been completed, the Contractor shall secure samples of water in the suitable containers and of sufficient quantity to have bacterial analyses made by a certified testing laboratory. Tests shall address each item specified in the Water Quality Analysis Table at the end of general technical specification. Expenses related to these analyses shall be borne by the Contractor and the results of the analyses shall be furnished to the Contract Officer Representative (COR).	L.S.	1		
2.4.8	**Disinfection of the well:** After completion of water well, or at the time of the yield and drawdown test, whichever is later, the water well shall be disinfected by adding chlorine, conforming to AWWA B301, or hypochlorite, conforming to AWWA B300, in sufficient quantity that a concentration of at least 50 ppm chlorine shall be attained in all parts of the water well. Chlorine solution shall be prepared and introduced into the water well in an approved manner and shall remain in the water well for a period of at least 12 hours. Disinfection of water well shall be in accordance with any method described in Section A1 thru A 10 of AWWA A100. After the contact period, the water well shall be pumped until the residual chlorine content is not greater than 1.0 ppm. The water well shall be disinfected and re- disinfected as may be required until two consecutive samples of water are found upon testing to be free from the Coli Acrogens group of organisms.	L.S.	1		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
3	**Submersible Pump :** Supply, installation, testing and commissioning of complete set of submersible pump for tube well of following capacity. The pump shall be water lubricated and shall be complete with all necessary accessories including motor, control/starter panel made of 16 SWG (1.6mm) sheet steel, circuit breaker, star-delta starter, protective devices, etc. The pump shall be supplies as per specification and installed as per direction of the Contract Officer Representative (COR). Type : Submersible for deep well Discharge : 1.0 lit/sec Pump size : 4.0 Hp Efficiency : 65% (minimum) Cable size : 4.00 sqmm, 1x3core Flat type Cable size : 1c-4x10.00 sqmm NYY From substation to pump room (BRB or Eastern cables) Power : 415 V, 50Hz, 3ph. Starting method : DOL Nominal speed : 2900 rpm NRV (Delivery Dia) : 100 mm DB Box : 60 amps (with TP,SP MCB & TPN BUSBAR) Column Pipe : 80 meter	Set	1		
4	**Sluice Valve and Non-Return Valve:** Supply, installation, testing and commissioning of sluice valve and Non-return Valve at the outlet of well discharge including necessary materials.				
4.1	100 mm dia sluice valve	Each	1		
4.2	100 mm dia non-return valve	Each	1		
			Sub Total (Tk)		

SECTION 02: ITEMS FOR SWITCH ROOM

Civil Works

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
1	**Earth work in excavation** in all kinds of soil for trenches including layout, providing center lines, local bench-mark pillars, leveling, ramming and preparing the base, fixing bamboo spikes and marking layout with chalk powder, providing necessary tools and plants, protecting and maintaining the trench dry etc., stacking, cleaning the excavated earth at a safe distance out of the area enclosed by the layout etc. All complete and accepted by the Contract Officer Representative (COR).	cum	15.0		
2	**Sand Filling** on the floor of switch room with local sand in layers not exceeding 150mm as directed and consolidating same by through saturation with water ramming complete including the cost of supply of sand all materials, labors, T&P, curing etc. All complete and accepted by the Contract Officer Representative (COR).	cum	2.0		
3	**Mass concrete (1:2:4) in foundation or floor** with cement, sand (F.M. 1.2) and picked jhama chips including breaking chips, screening, mixing, laying, compacting to levels and curing for at least 7 days including the supply of water, electricity and other charges and costs of tools and plants etc. All complete and accepted by the Contract Officer Representative (COR).	cum	1.0		
4	**RCC Work:**				
4.1	**Reinforcement cement concrete** work in slab, lintel and beam including cost of centering, shuttering, finishing and reinforcement with mixing ratio1:1.5:3 (1cement :1.5 sand: 3 graded stone aggregate 20mm nominal size)	cum	2.50		
4.2	**Reinforcement** for RCC works including straightening, cutting, bending, placing in position and binding all complete. Grade 60	Kg	550.0		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
5	**10" Brick work** with first class bricks in foundation up to plinth level in all shapes and sizes in: Cement Mortar 1:6 (cement :coarse sand)	cum	4.50		
6	**Exposed brick works** (for exterior wall without outside plaster) with automatic machine made first class bricks, very carefully laid in cement sand (F.M. 1.2) mortar (1:4)) in superstructure with uniform width and depth joints, true to vertical and horizontal lines including raking out joints scaffolding, soaking the bricks at least for 24 hours before use, washing and screening of sand. Curing at least for 7 days and high class flush pointing with cement sand (F.M. 1.2) mortar (1:1) including cost of water, electricity and other charges etc. All complete and accepted by the Contract Officer Representative (COR).	cum	8.50		
7	Minimum **12 mm thick cement sand (F.M. 1.2) plaster (1:4)** with fresh cement to wall inner surface, finishing the corner and edges including washing of sand cleaning the surface, scaffolding and curing at least for 7 days, cost of water, electricity and other charges etc. All complete and accepted by the Contract Officer Representative (COR).	sqm	44.00		
8	Supplying, fitting and fixing **M.S. door and window shutter** made with 1.5" x 1.5" x ¼" angle outer frame, inner member 1" x ¼" F.I. bar, cladding with 16 BWG M.S. sheet, hinged with 2" x 2" x ¼" M.S. angle Chowkat with 2 coats painting. All complete and accepted by the Contract Officer Representative (COR).	sqm	4		
9	**Window Grills:** Supplying, fitting and fixing **window grills made of 10 mm dia M.S. rod** @ 100 mm c/c fitted with 3 (three) Nos. horizontal M.S. flat bar (38 x 6 mm) including fabrication, welding, riveting, cost of electricity, workshop charges, carriage, fixing with pre-placed clamps in walls/RCC member for all floors etc. All complete and accepted by the Contract Officer Representative (COR).	sqm	1.25		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
10	**Damp proof course (DPC)** (1:1.5:3) in cement concrete with cement, sand (F.M. 1.2) and picked jhama or stone chips including breaking chips, screening, centering, shuttering, casting, curing and finished with a coat of bitumen including the supply of water, electricity and other charges and costs of tools and plants etc. all complete and accepted by the Contract Officer Representative (COR).	sqm	4		
11	**1/2 " Thick plaster on Skirting and Dado:** Supply and make minimum1/2" thick cement mortar plaster on skirting and dado. Ratio of mortar is cement: sand= 1:5 including net cement finish, washing of sand and curing at least 7 days, cost of water, electricity and other charges etc. All complete and accepted by the Contract Officer Representative (COR).	sqm	4		
12	**Provide** water proofing agent (Mr. Expert/ Equivalent) on the roof of pump house with 2 coats. All complete and accepted by the Contract Officer Representative (COR).	sqm	13		
13	**Painting:** Supply and apply acrylic emulsion paint in interior wall and ceiling of pump house. Apply in two coats over a prime coat, prepare surface properly. The rate also includes scaffolding. All complete and accepted by the Contract Officer Representative (COR).	sqm	44		
14	**75 mm thick cement concrete (1:3:6)** with cement in flooring best quality coarse sand and 19 mm downgraded picked chips including breaking chips, screening, mixing, laying, compacting, washing and screening of sand of F.M 1.2 and curing at least for 7 days etc. including cost of water, electricity and other charges etc. all complete and accepted by the Contract Officer Representative (COR).	sqm.	17		
			Sub-Total (Tk.)		

SECTION 03 : ITEMS FOR SWITCH ROOM
Electrical Works:

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
1	**Wiring:** (1) Concealed conduit wiring of the following points looping at the switch board with earth terminal including circuit wiring with 1c-2x1.5 sqmm and 1c-2x2.5 sqmm insulated sheathed standard cable (BYA) & 1.5 sqmm PVC insulated green/ white colored EEC wire (BYA) through PVC conduit of 25/20 mm dia, 1.5mm wall thickness. 18 SWG GP sheet switch board and pull box, 3mm ebonite sheet cover etc including mending good the damages. Conduit: Modern, Lira or Equivalent				
	a). Light point	Each	1		
	b). 2-Pin 5 Amp socket	Each	1		
	c). 3-Pin 13 Amp socket	Each	1		
	d). Fan Point	Each	1		
	(2) Concealed conduit wiring with following PVC insulated and standard cable (BYA) & insulated green/ white colored EEC wire (BYA) through PVC conduit. Complete with 18 SWG GP switch and pull box, 3mm thick ebonite sheet cover etc including mending good the damages. Conduit: Modern, Lira or Equivalent				
	a). 1C-2x2.5 sqmm BYA cable, 2.5 sqmm BYA EEC wire through pipe of inner dia 20 mm having wall thickness of 1.5mm.	Rm	20		
	b). 1C-2x4 sqmm BYA cable, 4 sqmm BYA EEC wire through pipe of inner dia 20 mm having wall thickness of 1.5mm.	Rm	20		
2	**Light Fitting:** Provide and fix 1-40 watt rod bulb in wall. Complete with bulb holder, shed, cover and other accessories. Brand: Philips or Equivalent.	Each	1		

Item No.	Brief Description of Works	Unit	Qty	Rate (Taka)	Total Amount (Taka)
1	2	3	4	5	6 = 4 x 5
3	**Fan Fitting:** Supply and fix AC capacitor type ceiling fan of the following size complete with 20 mm dia GI pipe of required length, canopy, blades, electronic regulator, PVC connecting wire, fan hook etc. All complete as per direction of the Contract Officer Representative (COR). a). 56" sweep, National or Equivalent brand.	Each	1		
4	**2-Pin Socket Out-let:** Provide and fix 2-pin, 5 Amp, 250 Volt socket outlet with control .switch, piano type local made, circuit connection to switch board and other accessories etc. All complete as per direction of the Contract Officer Representative (COR).	Each	1		
5	**3-Pin Socket Out-let:** Provide and fix 3-pin, 13 Amp, 250 Volt socket outlet with control .switch, piano type local made, circuit connection to switch board and other accessories etc. All complete as per direction of the Contract Officer Representative (COR).	Each	1		
6	**MK Gang Switch:** Supply and fix best quality MK switch including circuit connection to switch board and all other accessories. All complete as per direction of the Contract Officer Representative (COR).				
	a). 1-Gang switch	Each	1		
	b). 2-Gang switch	Each	1		
			Sub-Total (Tk.)		

SUMMARY OF COST

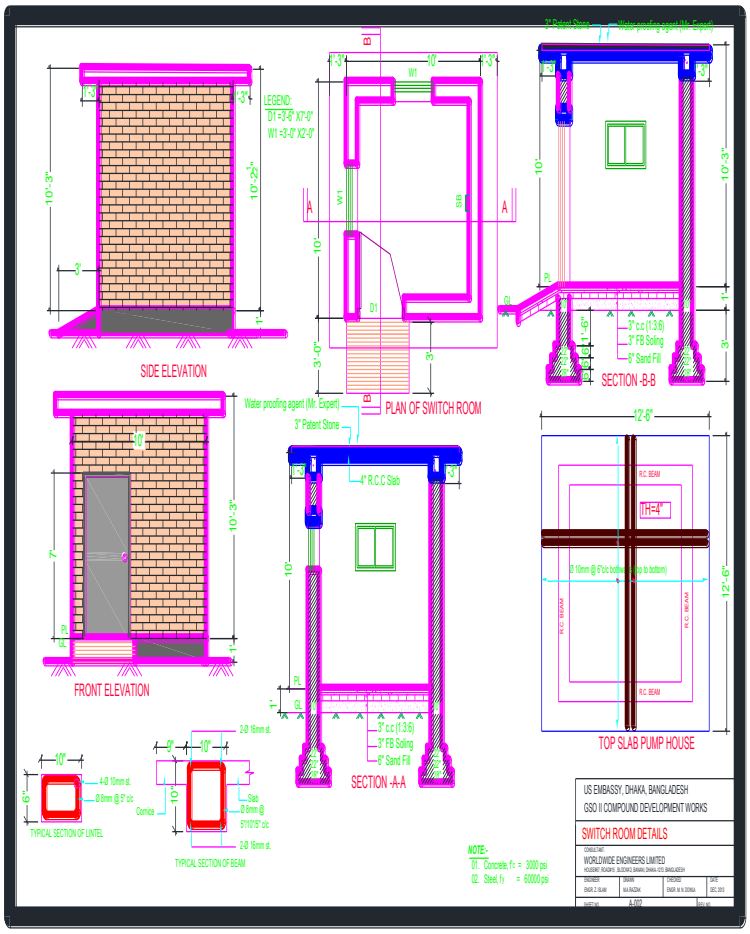
Grand Total(Tk.) = Section-01 + Section-02 + Section-03 = ……..

In word (Taka ……..)

Signature of Bidder ……

Seal & Address of Bidder …….

……


SIDE ELEVATION
FRONT ELEVATION
PLAN OF SWITCH ROOM
SECTION -B-B
SECTION -A-A
TOP SLAB PUMP HOUSE
TYPICAL SECTION OF LINTEL
TYPICAL SECTION OF BEAM
LEGEND:
D1 =3'-6" X7'-0"
W1 =3'-0" X2'-0"
3" Patent Stone
Water proofing agent (Mr. Expert)
4" R.C.C Slab
3" c.c (1:3:6)
3" FB Soling
6" Sand Fill
TH=4"
US EMBASSY, DHAKA, BANGLADESH
GSO II COMPOUND DEVELOPMENT WORKS
SWITCH ROOM DETAILS
WORLDWIDE ENGINEERS LIMITED
NOTE:-
01. Concrete, f'c = 3000 psi
02. Steel, fy = 60000 psi